

[DNFSB LETTERHEAD]

June 18, 1997

The Honorable Alvin L. Alm
Assistant Secretary for Environmental Management
Department of Energy
1000 Independence Avenue, SW
Washington, D.C. 20585-0113

Dear Mr. Alm:

Members of the Defense Nuclear Facilities Safety Board (Board) were briefed on May 6, 1997, by personnel from the Department of Energy Richland Operations Office and Bechtel Hanford, Incorporated (BHI) regarding safety management of facility decommissioning work. As part of the briefing, BHI described its work flow process; identified several areas for continued improvement; and described selected recent events to highlight [work planning and implementation](#) deficiencies, their causes, and associated corrective actions. The Board's staff and outside experts have also been monitoring the work flow process, and have prepared reports documenting deficiencies in [work planning and conduct of operations](#) that may be helpful to the improvement effort. These reports are enclosed for your information. If you have any questions, please do not hesitate to contact me.

Sincerely,

John T. Conway
Chairman

c: The Honorable Tara O'Toole
Mr. Mark B. Whitaker, Jr.
Mr. John Wagoner

Enclosures

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

April 21, 1997

MEMORANDUM TO: G. W. Cunningham, Technical Director

COPIES: Board Members

FROM: D. G. Ogg

SUBJECT: Work Planning and Conduct of Operations at the Hanford N Basin

1. Purpose

This report documents observations of work activities at the N Basin, Hanford Site, Richland, Washington. The Environmental Restoration Contractor, Bechtel Hanford, Inc. (BHI), conducts deactivation activities at the N Basin for the Department of Energy, Richland Operations Office (DOE-RL). The Defense Nuclear Facilities Safety Board (Board) Hanford Site Representative, D. G. Ogg, assisted by outside expert D. S. Boyd, conducted reviews on three separate occasions during March 27–April 2, 1997.

2. Summary

On March 25, 1997, BHI workers removing electrical conduit in the Examination Pit of the N Basin cut through an energized 240-volt line. No one was injured. Causes for this event included poor procedural compliance, inadequate identification of workplace hazards, and inadequate control of those hazards in the work procedure. This event prompted the Hanford Site Representative to conduct a more detailed review of BHI activities at the N Basin.

Observations at the N Basin indicated several weaknesses in BHI work planning, conduct of operations, and radiological controls. Several of these poor practices were aggravated by procedures not being specifically written for the work at hand, and by the lack of adequate prejob planning and walkthroughs. Section 4 provides details of these observations. The Board's staff believes BHI could benefit from a more thorough and rigorous program to identify workplace hazards and controls for those hazards. A working integrated safety management system of the type suggested in Board Recommendation 95-2 would provide this sort of program.

3. Background


The deactivation work at the N Basin includes low-dose (< 1 roentgen [R]/hr on contact) hardware removal, water filtration, basin sediment relocation, and high-exposure-rate (> 1 R/hr on contact) hardware removal. While BHI continues to make progress in the deactivation work, the project has experienced delays due to revisions in the safety basis and a stand-down due to deficiencies in conduct of operations. Other occurrences included unexpected hydrogen gas evolution from a grouted monolith, the drop of a 14-ton monolith from the overhead crane to the basin floor, and a crane

operator moving off the crane without required fall protection.

4. Discussion

Electrical Conduit Cutting Near-Miss. During follow-up for the near-miss event of March 25, 1997, the Board's staff learned that causes for this event included both poor conduct of operations and inadequate procedures. The electrician who signed the procedural hold point confirming completion of zero energy checks did not complete the checks immediately prior to the work (he had completed the checks several months earlier).

A procedural inadequacy directly related to the near-miss event is the statement of isolation conditions in the work package that reads, "Lock and tag the system out-of-service with a Controlling Organization Lock and Tag, if the isolation breaker or disconnect switch can be traced." The workers skipped this hold point, because they believed they could not trace the power source. However, during the work, the workers cut through a conduit containing an energized 240-volt line they believed to be deenergized. More thorough prejob planning and walkthroughs could have caught and corrected these problems.

Airborne Radioactivity Postings. While touring the N Basin on March 27, 1997, the Board's staff observed airborne radioactivity area (ARA) postings on handrails that surrounded the Examination Pit (see  [Figure 1](#)). No physical barriers separated the air space of the posted airborne area from the unposted areas. The prejob briefing for the tour did not include mention of an ARA, nor was one identified on the radiological survey map. Walkways allowed access to basin areas that surrounded the posted area.

Upon further investigation, the Board's staff learned that N Basin management had stopped the cutting work (the near-miss event) requiring the postings, but that the radiological controls (radcon) organization had not authorized downposting of the area. Air samples taken after the work, which indicated potentially high airborne contamination levels, had not had sufficient time for the radon contribution to decay. Later, the radcon organization confirmed the presence of radon and removed the ARA postings.

The radiological work permit (RWP) for the cutting work in the Examination Pit requires that workers engaged in the cutting activity wear respirators. The work package also requires that both alpha and beta continuous air monitors (CAMs) be operational during the work. However, the work planning documentation has several weaknesses:

- An air sampling plan for the work requires "periodic high-volume air sampling," but does not specify how often and where the air samples are to be taken.
- Although the radcon organization secured walkway access "downwind" of the west end of the Examination and Segregation Pits, neither the RWP nor the work package mentions or requires that access be limited.

- Neither the work package nor the RWP required workers in the general N Basin area but outside the Examination Pit to wear respirators.

Pressure Gage Replacement Job. BHI workers replaced a discharge pressure gage on an Aquadyne hydro laser on April 1, 1997. The overall job required about 1 hour at the work site, including about 5 minutes for the actual gage replacement. Controlling organization lockouts/tagouts were placed on the pump motor electrical plug and the water supply valve. The equipment was located in a high-contamination area (HCA) in the transfer bay. The Board's staff made the following observations concerning the planning, documentation, and conduct of this job:

- Workers used a task instruction covering nonspecific Aquadyne troubleshooting, but did not adapt the instruction for the specific work to be accomplished. Many steps, such as those concerning the drip pan, were considered to be not applicable and were skipped by the craft supervisor. Also, the zero energy check for water pressure consisted of looking for water coming out of the hose, but the end of the hose was under the water's surface.
- As planned and written, the task instruction unnecessarily maintained an HCA around the Aquadyne. This was recognized during the job by the workers and the radiological control technician (RCT), who then surveyed the area and obtained authorization to post it temporarily as a CA.
- Workers who placed and independently verified the lockout/tagout on the electrical cord accepted that the craft supervisor had correctly identified the plug (which he had), but did not check for themselves. The electrical cord was intertwined with hoses and other electrical leads, and its identity was not self-evident.
- Planning for the job did not address how to lock the water supply valve shut, and a standard locking device was not available. Had the craft supervisor not improvised a locking device from a length of chain, a significant delay could have resulted.
- The BHI work control process allowed the discharge pressure gage to be replaced without the cause of the failure having been adequately determined. After hydro laser operation had resumed, the gage failed again the following day. BHI then learned, after contacting the manufacturer, that operating the nozzle too close to, or in contact with, the surface being cleaned can cause pressure pulses that can over-range the gage.

Chemical Additions to the Basin Water on April 2, 1997. Workers completed this work in accordance with a BHI demand work request. The following observations provide additional examples of poor prejob planning:

- Many pen-and-ink changes had been made in the working copy of the document, with no indication that a review and approval process had been followed. Some

changes concerned technical content and work authorization.

- Workers began chemical additions without establishing an emergency shower/eyewash at the job site as required by the work document. Later, after an RCT recognized the problem, another worker corrected the deficiency.

5. Future Staff Action

The Board's staff continues to emphasize to DOE and its contractors the need for working programs that implement an integrated safety management system. The Hanford Site Representative Office will continue to prompt DOE-RL on this subject, and to provide oversight of BHI and other contractor activities.

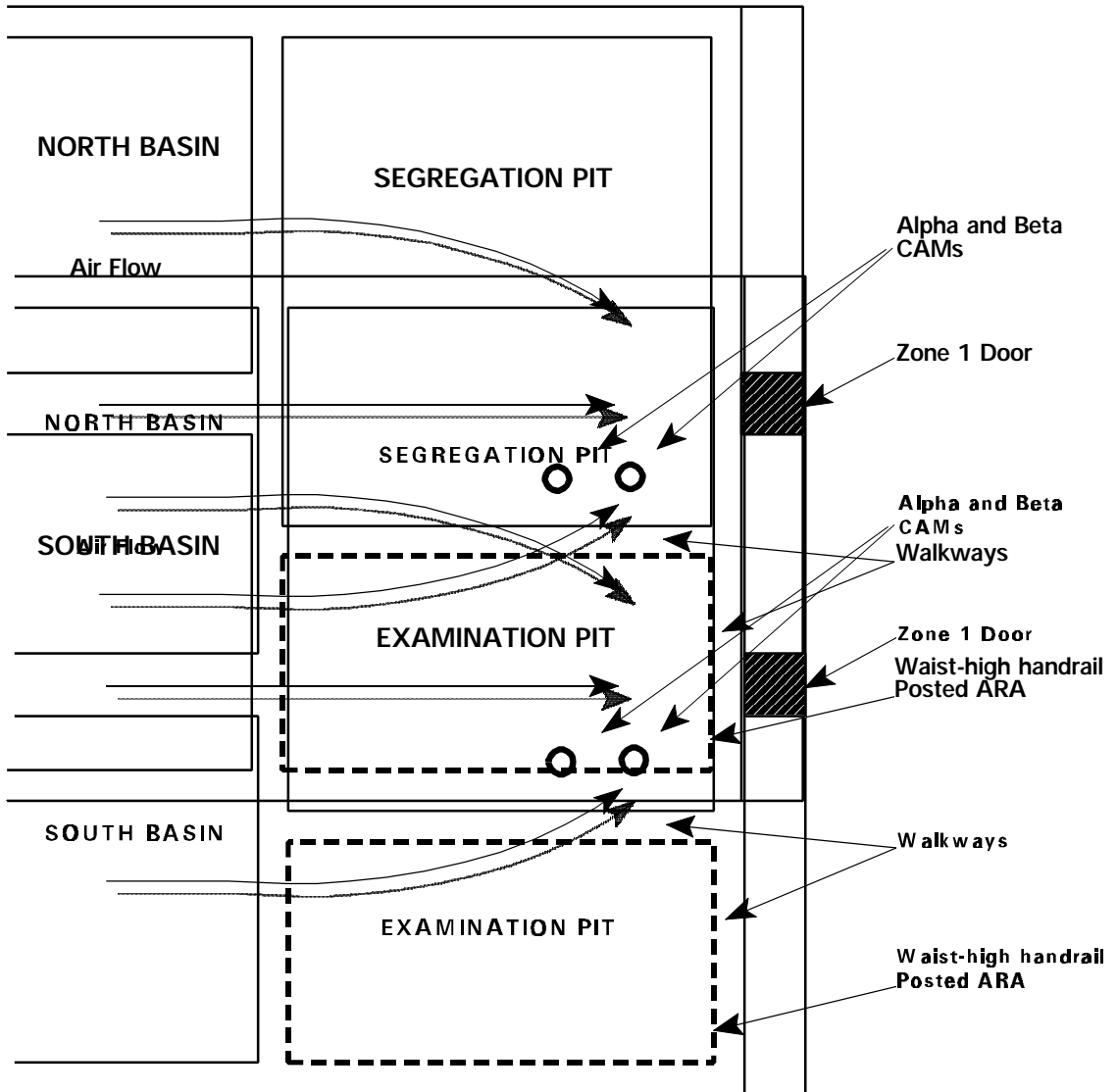


Figure 1. N Basins, East End

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

April 18, 1997

MEMORANDUM
FOR: G. W. Cunningham, Technical Director
COPIES: Board Members
FROM: J. W. Troan
SUBJECT: Review of Work Planning and Implementation at Bechtel Hanford Incorporated (BHI) Activities

1. Purpose

This report documents a review of work planning and implementation at Bechtel Hanford Incorporated (BHI) activities. The review consisted of a visit made to the Hanford Site on February 19–20, 1997, by Defense Nuclear Facilities Safety Board's (Board) staff members D. L. Burnfield, J. A. DeLoach, and J. W. Troan; subsequent to this on-site visit, the staff reviewed relevant BHI procedures and selected work planning and implementation documents.

2. Summary

The work planning function used by BHI is in place; however, some portions of it are not fully developed. Therefore, it does not ensure that all hazards are comprehensively identified, and that corresponding controls are developed and implemented. The process of identifying hazards during the Activity Hazard Analysis (AHA) lacks the necessary rigor to ensure that complicating factors are included in the analysis. Similarly, in some cases, the development and implementation of controls do not follow a disciplined approach. The following observations from the Board's staff review are highlighted:

- Some of the methods and procedures used to identify and analyze hazards during the work planning process are immature and lack rigor. However, there are other safety and hazard analysis processes that may help to reduce this shortfall if pertinent information is integrated into the specific work plans.
- Controls are generally defined, but sometimes lack detail and correlation with a specific hazard. Furthermore, controls are not always consolidated into a single work procedure.

3. Background

A fundamental part of work planning and implementation is hazard identification and control. The process of identifying and analyzing hazards is usually interdisciplinary, and typically involves personnel from engineering, criticality safety, industrial hygiene, and radiological protection. This interdisciplinary approach should lead to a

work package that integrates the engineering, operations, maintenance, and safety disciplines, and forms a cohesive and logical set of instructions and appropriate controls for accomplishing the work in a safe and effective manner.

One critical aspect of work planning involves controlling the radiological hazards identified for each task. Requirements and guidelines for protecting workers from radiological hazards are provided in the Department of Energy's (DOE) final Rule 10 Code of Federal Regulations (CFR) 835, *Occupational Radiation Protection*; 10 CFR 835 Implementation Guides; and the *DOE Radiological Control Manual* (DOE/EH-0256T, Rev. 1). These requirements and guidelines are consistent with those contained in DOE Order 440.1, *Worker Protection Management for DOE Federal and Contractor Employees*. Carefully implementing these requirements and guidelines in an appropriate manner should ensure the inclusion of adequate radiological controls in the work package.

Using 10 CFR 835 and the associated guidance documents, as well as the approach discussed in the Implementation Plan for Board Recommendation 95-2 for integrated safety management, the Board's staff evaluated the methods used to identify hazards and implement controls at BHI activities.

4. Discussion

The Board's staff reviewed procedures used to plan and carry out selected work at the N Reactor Spent Fuel Storage Basin (N Basin). These procedures included work packages associated with the sorting and collection of high exposure rate hardware (HERH) and removal of the monolith of grouted HERH. HERH comprises primarily items irradiated by neutron exposure during N Reactor operations, and most of the HERH in the basin consists of reactor process tubes. In addition to the HERH items, this activity also includes the removal and dispositioning of spent Tri-Nuclear filter cartridges that have been used to maintain basin water clarity. The hardware is expected to exhibit contact "dose rates significantly greater than 1 Roentgen per hour [sic]." The material is collected and encapsulated in grout while underwater. The grout encapsulation is removed from the water, placed in a cask, and transported to an on-site burial ground.

The staff also had discussions with DOE-Richland Operations Office (DOE-RL) staff, Washington State regulators, and BHI personnel, including managers, engineers, planners, technicians, and the work force, and observed work at the N Basin.

The following discussion highlights the significant observations made by the Board's staff during the review. Detailed observations related to BHI work planning and implementation are provided in an [attachment](#) to this report.

Identification and Analysis of Workplace Hazards. The Board's staff reviewed work activities at N Basin conducted by BHI. Methods and procedures used by BHI to identify hazards were immature and lacked rigor. In its procedures, BHI states that the AHA is used to document hazards and control measures for a variety of tasks carried out on Environmental Restoration Contract (ERC) projects.¹ The Board's staff

reviewed AHAs prepared for work at the N Basin and found that the current AHA is only a checklist that is used to prompt consideration of the existence of a particular hazard, where hazards are identified by a simple one- or two-word description. In addition to this process, BHI has a separate procedure used for planning radiological work, which describes the process used to determine review criteria, radiological risk, and minimum resource requirements.²

The Board's staff found that BHI allows a graded approach for requiring the analysis of hazards that is dependent on the scope of the work. If the work fits into the scope of 29 CFR 1910.120, *Hazardous Waste Operations and Emergency Response*, BHI uses a Site-Specific Health and Safety Plan (SS HASP). Alternatively, if the scope of work is outside 29 CFR 1910.120, an AHA or a work procedure that specifies definite safety and health controls approved by the ERC Safety and Health group is used. For example, an AHA is not required for work that is categorized as "routine." However, additional controls, as appropriate for the particular workspace conditions, are implemented based on a supervisor's assessment of the work area. The Board's staff believes that although a graded approach has utility, a more disciplined method for specifying hazard analysis methodologies and determining how hazard evaluations are to be conducted would help ensure that hazards are identified and analyzed, and appropriate controls implemented.

The Board's staff discovered that BHI analyzed and documented hazards independently of the AHA process. Specifically, for N Basin, BHI analyzed hazards for both the quiescent state and planned intrusive activities (e.g., HERH removal), and documented those hazards, along with mitigating features and controls, in the *Final Hazard Classification and Auditable Safety Analysis for the N Basin Segment* (BHI-00968, Rev. 0). Based on the content of this document, it appears to the Board's staff that this approach to identifying and describing hazards was much more rigorous than the AHA process; however, it is not apparent that there is a disciplined process for using this information with the AHA when planning work. Moreover, although this approach to hazard identification and analysis is more detailed than the AHA, some portions of the analysis lacked technical justification.

BHI may prepare other permits or analyses for the noted hazards. For example, a Radiation Work Permit (RWP) is prepared when there is work in a radiological area. The Board's staff reviewed an RWP for the HERH removal project and found it contained information that further supported hazard assessment and controls. Specifically, it contained a technical assessment, an As Low As Reasonably Achievable (ALARA) Job Review, an ALARA Checklist, an ALARA Controls Record, and other technical guidance. Notwithstanding this documentation, the staff found shortcomings with the analysis. For example, the *ALARA Plan for High Exposure Rate Hardware* (BHI-00825) did not fully characterize the hazard since it did not provide a description of the expected contamination and airborne radioactivity levels.

The Board's staff believes that because of the limited and potentially fragmented approach used by BHI to identify and describe hazards, significant hazards associated with a task may not be completely characterized or fully analyzed during work

planning. If hazards are not fully assessed, the associated controls may not be appropriately applied.

The staff has noted the implementation of more formal and rigorous approaches to hazard identification and analysis at other facilities, such as PUREX at Hanford and the Chemical Processing Plant at Idaho National Engineering and Environmental Laboratory (INEEL). The approach at these sites relies on a team effort, where appropriate, and uses some concepts and techniques for hazard identification and analysis identified in the *Guidelines for Hazard Evaluation Procedures* (Center for Chemical Process Safety, 1992). The various techniques identified in this book are designed to be applicable to a wide spectrum of work, from simple, low-risk to complex, high-risk activities.

Implementation of Workplace Controls. When an AHA is conducted, controls to protect the workforce or to mitigate hazards are to be identified. Following hazard identification, BHI uses a Job Hazard Controls Checklist (JHCC) to outline primary control measures to be used to control/mitigate health and safety hazards for each item that is checked "yes" on the hazard analysis. The JHCC contains boxes that are individually titled with the type of hazard, and each contains brief description(s) of measures for mitigating the respective hazards. The Board's staff found these measures to be relevant to the general hazards. However, the staff found no guidance for completion of the JHCC to ensure that engineered controls will be implemented where practical. Consequently, the staff found that the measures are sometimes too generic, and is not confident that the controls are detailed enough to support effective implementation. For work conducted in a radiological area, an RWP is required, and controls such as the type and quantity of personal protective equipment (PPE) are specified.

As noted in the previous section, BHI prepared a document titled *Final Hazard Classification and Auditable Safety Analysis for the N Basin Segment* (BHI-00968, Rev. 0). In addition to identifying hazards and mitigating features and controls, this document specifies special controls that are necessary to ensure that the conditions assumed in the bounding accident analysis are not exceeded. In the case of HERH removal, controls such as limiting general contact dose rates and maximum monolith lift height are given. The staff reviewed the work procedure for the removal of HERH Monolith #9 (Demand Work Request 19961008005), and found that these special controls were incorporated into the precautions/limitations or were steps in the procedure. However, the staff believes the integration of some of these controls into the work procedure could be improved.

The Board's staff attended a prejob brief for HERH sorting and collection, and observed this work at the N Basin. The staff found that production management and workers were generally well organized, conversant, and knowledgeable. During the prejob brief there was confusion regarding the selection of the appropriate RWP; however, the Field Superintendent recognized that the inappropriate RWP was being used in the briefing and corrected the error. Inappropriate selection of a Job Specific RWP may result in inadequate controls, since RWPs specify different radiological controls based on a particular scope of work and radiological conditions.

The development and implementation of controls did not follow a well-disciplined approach, and it was not apparent that a deliberate process is in place to implement and verify control measures. The Board's staff believes it may be appropriate to have more integration of requirements (e.g., precautions, limitations, hold points) in technical work documents.

5. Future Staff Action(s)

The Board's staff intends to follow selected work at BHI activities, and will continue to evaluate the BHI work planning process and implementation of work.

ATTACHMENT

DETAILED OBSERVATIONS RELATED TO BECHTEL HANFORD INCORPORATED (BHI) WORK PLANNING AND IMPLEMENTATION

The following highlights the significant observations made by the Board's staff regarding hazard identification:

- The *As Low As Reasonably Achievable (ALARA) Plan for High Exposure Rate Hardware* (BHI-00825) does not provide sections describing the expected contamination and airborne radioactivity levels. This omission is contrary to Procedure 1.22, *Planning Radiological Work*, §7.4, "ALARA Review."
- The completed Activity Hazard Analysis (AHA) for Monolith #9 removal of high exposure rate hardware (HERH) (Demand Work Request 19961008005) does not describe hazards beyond a simple one- or two-word description (e.g., "Respiratory Hazards").
- Hazards and controls for personnel falls from the crane platform during HERH sorting and collection (Demand Work Request 19961007002, Rev. 2) are not completely identified and implemented. The hazard analysis included in the work package for collection and loading of HERH metals indicates that elevated work is not applicable to the job, and no controls are identified in the Job Hazard Controls Checklist. Moreover, hazards and mitigating controls associated with excessive leaning over the rail on the crane's platform are not explicitly addressed in the work procedure or the Job Hazard Controls Checklist. In the document titled *Final Hazard Classification and Auditable Safety Analysis for the N Basin Segment* (BHI-00968, Rev. 0), an individual immersion event from falling into the basin is analyzed. Mitigating features for an individual immersion are discussed (e.g., pool is surrounded by guardrails, and recovery procedures are available), and no special controls are identified as being needed to ensure that the conditions assumed in the bounding analysis are not exceeded. There is no mention of controls to mitigate the occurrence of a person working aloft on the crane platform while reaching into the pool with tools.
- Subsequent to the on-site visit, the Board's staff reviewed Job Specific Radiation Work

Permits (RWPs) NB-0037, Rev. 9, and NB-0070, Rev. 3, and found that approximately 16 of the same Demand Work Request packages are approved for use under both RWPs. This practice of broad applicability of an RWP is questionable because of the potential differences in scope of work and radiological conditions that may be encountered during implementation of the different work packages.

The following highlights the significant observations made by the Board's staff regarding workplace controls:

- As discussed above, hazards are typically identified in the AHA by simple one- or two-word descriptions. For example, in the completed AHA for Monolith #9 removal of HERH (Demand Work Request 19961008005, Rev. 0), respiratory hazards are identified; however, information that further describes the hazards and controls is lacking. In the Job Hazard Controls Checklist, the following specific information is not included: (1) the hazard or potential hazard is not quantitatively characterized, (2) specific engineered controls are not given, and (3) there is no mention of monitoring or thresholds for action.
- Information regarding air sampling is attached to RWP NB-0070: in a memorandum regarding an update to the air sampling technical assessment (CCN: 033059, dated July 2, 1996), brief high-volume air sampling instructions are given. Specifically, to verify that the level of respiratory protection provided to the workers is adequate, air samples are to be taken downwind of the most exposed worker. The Board's staff questions this practice, since it would be advisable to obtain a more representative sample by sampling between the source and receptor, vice after the receptor. The original air sampling technical assessment is not included; however, in RWP NB-0037 there is a handwritten note that refers to a document identified as "CCN 033059," the "air assessment plan." The staff believes this plan provides limited guidance, and is not confident that the need for air sampling has been adequately assessed, or that air samples and results are appropriately programmed.
- RWP NB-0070 states that air samples are to be taken in accordance with the air sample assessment plan; however, a detailed plan is not given in the RWP or the Demand Work Request. Although the RWP states that a full-face negative pressure respirator is the minimum required in the airborne radioactivity area (ARA), special instructions do not give airborne radioactivity concentration limits for suspension of work. Furthermore, air sampling requirements are not directly integrated into the work procedure.
- An ALARA Checklist is included with RWP NB-0070. In this checklist, Item 1.5, "Special tools considered," states that specially made spray rings will be used to apply fixative to the monoliths remotely as they are removed from the water; Item 5.7, "Decontaminate area/equipment," states that the work package requires that the monolith be high-pressure washed and painted as it is removed from the water. Contrary to the ALARA Checklist, Demand Work Request 19961008005 for Monolith #9 removal of HERH, Section 5.5, "Removing Monolith and Placing in L3-181 Shipping Cask, step 17," directs application of the fixative to the exterior of the monolith after the monolith has been removed from the water. The fixative is to be

applied with long-handled spray wands, or by other painting techniques and tools with the approval of the Radiological Control Supervisor, the Field Superintendent, and the Safety and Radiological Engineering organizations. In this regard, it appears that the ALARA Checklist does not properly characterize the work controls.

- The Pre-Job Safety Meeting/Work Package Review located in Demand Work Request 19961008005 for Monolith #9 removal of HERH refers to two RWPs, NB-0037 and NB-0070. The Board's staff questions the applicability of RWP NB-0037. RWP NB-0037 states that if the basin is not under high radiation area (HRA) controls, removal, painting, and loading of monoliths for shipment or storage will occur under this RWP. However, it is not clear how this applies to Demand Work Request 19961008005 for Monolith #9 removal of HERH, since the Demand Work Request's Section 3.0, "Precautions/Limitations," Item 6, states that HRA controls shall be in place during the removal of a monolith.
- RWPs NB-0070 and NB-0037 are in conflict regarding air sampling. Both state that air samples will be taken in accordance with the air sample assessment plan. However, RWP NB-0037 contains a memorandum stating that no air sampling is required. This statement is modified by a handwritten statement requiring air sampling for the LEL testing, to be conducted in accordance with an attached air assessment plan, CN: 0033059. The Board's staff is not aware how "LEL testing" relates to the HERH work, and the plan is not attached to RWP NB-0037.
- *The ALARA Plan for High Exposure Rate Hardware* (BHI-00825), Section 6.0, "Airborne Radioactivity Controls," states that the following controls are to be used to regulate airborne radioactivity concentrations during HERH removal: high-pressure washing of the grouted monolith underwater; spraying off of the monolith with potable water; application of a fixative to items to contain contamination, whenever possible; and painting of items to reduce the potential for generating elevated airborne radioactive concentrations during normal operations, storage, and decontamination efforts, thereby allowing work crews to work without the use of respiratory protection. Furthermore, the ALARA Plan states that an air sampling technical assessment has been written to provide guidance concerning air sampling requirements to the Radiological Control Technicians. Since it appears important to apply fixative to the monolith in order to avoid potential airborne radioactivity resuspension, the Board's staff questions why controls such as limiting the time a monolith is exposed without being fully coated with a fixative are not specified. During the visit to the N Basin, the Field Superintendent stated that dry-out of the monolith's surface was taken into consideration; however, the staff found that in this case, formal controls such as prevention of dry-out of the monolith surface to preclude resuspension of airborne radioactivity before the monolith is placed in a transportation cask were not proceduralized.
- Demand Work Request 19961008005 for Monolith #9 removal of HERH, Section 5.5, "Removing Monolith and Placing in L3-181 Shipping Cask," does not identify the special controls necessary to ensure that the conditions assumed in the bounding accident analysis are not exceeded. Specifically, it does not specify the general contact

dose rate limits on a monolith after it has been removed from the water. Although these controls are identified in the "Precautions/Limitations" section, the Board's staff believes they would be useful in Section 5.5. In two instances, "warnings" that high dose rates are expected from the monolith are given in the procedure; however, requirements to measure general area radiation levels are not specified for the period following removal of the monolith from the water and its transfer to the high contamination area (HCA). It is not until step 16, a radiological control hold point, that the Radiological Control Technician is to "establish dose rates" following transfer of the monolith to the HCA. This important step appears vague and without proper amplification (e.g., description of required survey and corresponding dose limits). Dose rate controls for movement of the monolith following its removal from the water, similar to those used when the monolith was raised toward the water's surface (e.g. <80 milli-Roentgen [mR]/hr [sic]) may be helpful in identifying and controlling high general area exposure rates and keeping exposure ALARA.

- Details regarding controls to mitigate potential hazards at the N Basin caused by mixing aluminum parts with monolith grout were not identified in early versions of the technical work documents. BHI has subsequently corrected this oversight.
- During a tour of the N Basin area, BHI personnel pointed out to the Board's staff that the electronic repair technician was still required to wear three sets of gloves (including a set of heavy work gloves) with his personal protective clothing, even though he worked in a specific area that had undergone a contamination-reduction process and was touted as the "cleanest" area in N Basin. In this case, the hazards for this specific work activity had not been fully analyzed, permitting the proper selection of controls and thus allowing the technician to work more effectively and possibly to conduct his electronic repair more quickly.

¹BHI-SH-02, "Project Safety Planning and Documentation," Vol. 1, Procedure 1.7, Rev. 2.

²BHI-SH-02, "Planning Radiological Work," Vol. 1, Procedure 1.22, Rev. 2.