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Rev. 0

ALARA Review for the Sediment Relocation and Removal from the 105-N Fuel Storage Basin

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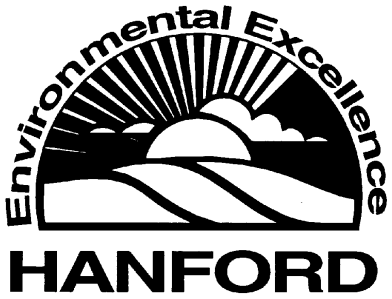

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1.0 INTRODUCTION

This as low as reasonable achievable (ALARA) review revision provides a description of the engineering and administrative controls used to manage personnel exposure, control contamination levels, and airborne radioactivity concentrations during sediment relocation and removal in the 105-N Fuel Storage Basin. Changes to the work scope that necessitated this revision include the following:

- Failure of the Remotely Operated Sediment Extraction Equipment (ROSEE) to perform as anticipated

- Change in methodology to use the three-phased approach to achieve success in this process, which consists of the following:

    - pick and place hardware removal
    - sandpiper vacuuming
    - final airlift of small debris

- extended operations under poor water clarity conditions

- greater quantities of sediment than initially assumed

- substantially greater quantities of hardware that required removal to access the sediment

- extremely fine physical nature of the sediment proved to be more difficult to capture than anticipated.

Because of the above items, additional personnel hours have been expended, and due to the failure of ROSEE, personnel are performing the operation in areas with greater exposure rates.

This document updates and supercedes the ALARA review of the sediment-related activities contained in *100-N Basin Stabilization Project As Low As Reasonably Achievable Plan,* (BHI 1995). In addition, this document incorporates the changes to the work scope presented in the "in-progress" ALARA review performed on December 9, 1997 (DeMers 1997) and includes the additional scope of sediment removal and disposal.

2.0 DESCRIPTION OF PROJECT

Relocation and removal of the N-Basin sediment are critical elements in the deactivation of the 105-N Fuel Storage Basin. A layer of sediment composed of rust corrosion and other small fine particles covers the basin floor surfaces. The sediment layer varies in depth from 2.54 to 10 cm (1 to 4 in.) and is deeper in certain areas, such as corners. A significant quantity of debris has contributed to the difficulty of this task and necessitated process changes. The sediment will be relocated from the main basin to the North Load Out Pit, where it will be collected and sampled.

Once all of the sediment has been relocated, removal and stabilization will be performed using subcontractor-supplied systems and containers. The resultant stabilized waste will be disposed of at the Environmental Restoration Disposal Facility.

2.1 CHANGES AND MODIFICATIONS TO THE PROJECT

The initial plan to relocate the sediment involved the use of the ROSEE system. Under this plan, a remote robot tractor was to be used to perform much of the work. This would have allowed the operator to work in a low dose area and therefore, exposure would be minimized.

Early in the project the robot tractor failed. After numerous attempts to make the ROSEE system work, it was abandoned. As a result, the operator of the vacuum equipment would now have to work in an area with higher dose rates for the remainder of the work. Poor water clarity and lack of visibility have greatly complicated this task and increased the amount of time spent in this effort.

For well over a year, many approaches, systems, and techniques were attempted to try to resolve the water clarity problem, but failed. Finally, by the use of micro-filtration, adequate water clarity was achieved in late spring of 1997. Once water clarity was sufficiently improved, it was discovered that a significantly larger amount of debris was present on the floor of the basin than had originally been anticipated. This new discovery made the use of the current ROSEE system very inefficient. As a result, the concept of using air-lifting tools was pursued.

The development and operation of this new device added additional time and exposure to the process; however, this was necessary because of the discovery of the additional debris. The operation of the air-lifting tool caused water clarity problems that resulted in additional exposure during the task. To improve this process, the use of alternative vacuum pumps was developed. In parallel to the air-lift development, the development of improved vacuuming methods resulted in the implementation of sandpiper pumps in lieu of the ROSEE pumps. This improvement allowed for more efficient removal of the sediment, but also required additional time to be spent on the bridge crane.

One final problem was that some of the sediment had hardened and solidified. This required high-pressure washing of the sediment to break it up prior to vacuuming. These considerations and difficulties have led to the development of the current three-phased approach (as discussed in Section 1.0) that will be used to complete the sediment removal process. As a result of the numerous problems encountered during the course of the work, it has become necessary to revise the dose estimate for the N-Basin sediment relocation and removal.

3.0 EXPOSURE ESTIMATE

The original estimated total worker dose equivalent was approximately 6 person-rem, which did not include sediment disposal. The revised estimated total worker dose equivalent to be received during sediment relocation and removal work is approximately 32.19 person-rem.

While making the dose equivalent estimate, a number of assumptions were made. Some of the major assumptions used in the development of these estimates include the following:

- An average dose equivalent rate of 7 mrem/hr on the bridge crane during pick and place, sediment relocation, and small debris removal.
- An average general area dose equivalent rate of 3.5 mrem/hr in the N-Basin transfer bay area during sediment disposal.
- General area removable contamination levels of <20 dpm/100cm^2 alpha and <3000 dpm/100cm^2 beta-gamma in areas occupied by the workers.
- Removable contamination levels inside of the system, liner, and north cask pit. Items used in these areas are expected to range from 200 to 50,000 dpm/100 cm^2 alpha and 5,000 to 1,000,000 dpm/100 cm^2 beta-gamma.
- Underwater pick and place and vacuuming operations are not disruptive and no anticipated generation of airborne radioactivity.
- During airlift operations the basin will be controlled as an airborne radioactivity area (ARA).
- Airborne radioactivity will be controlled by the use of engineering controls, such as applied ventilation for sediment removal.

4.0 EXPOSURE CONTROL

The task of relocation and removal of N-Basin sediment has numerous challenges, one of which is controlling exposures. In this document, controlling exposure is managing exposures ALARA. Controlling exposure to radiation workers is administered through both engineered and administrative controls.

Time, distance, and shielding are being employed throughout the entire job. The use of remaining water, temporary shielding on the transfer line, and the use of the provided shielded process cask will be the primary controls to reduce external dose rates in the basin work area. Because of the dynamic nature of the work process involved, organized planning and execution are required to keep exposures ALARA. Organized work planning reduces the number of

personnel required to perform the work and reduces occupational time inside the basin. Additionally, the use of in-progress monitoring of radiological conditions will be performed to verify conditions during processing.

During the planning process, a number of areas for reducing/controlling exposure were identified. Some of these areas included the following:

- Work underwater to minimize external exposure and airborne potential.
- Install shielding on the transfer line as part of the pre-job preparation.
- Decontaminate the cask pit walls to minimize airborne potential.
- Fix contamination using paint wherever possible.
- Use long-handled tools that can be operated remotely.
- Use of engineered ventilation systems for processing to minimize the areas affected by airborne radioactivity.
- Any work performed in high radiation areas will require personnel to be briefed on a High Radiation Area Access Control Plan.

5.0 CONTAMINATION CONTROLS

The following three radiological areas will be established for controlling contamination during sediment relocation and removal work:

- Radiological Buffer Areas
- Contamination Areas
- High Contamination Areas (HCA).

The establishment of each area is dependent upon the work being performed, the engineered controls in place, and the planned contamination levels as identified in Radiation Work Permits (RWPs) and the work package.

Controlling contamination during the sediment relocation and removal process will be accomplished by using a combination of administrative and engineered controls. These controls will be used to minimize the spread of contamination and reduce the levels of contamination.

A number of engineered controls have been identified in the development of the sediment relocation and removal work packages. Of these controls, the most effective are ventilation,

keeping surfaces wet, high-pressure washing of surface, and fixing contamination in place. Proper ventilation and keeping surfaces wet will help prevent the migration of contamination from the north cask pit area. High-pressure washing of underwater surfaces prior to and during water removal will minimize a majority of the removable contamination on the north cask pit surfaces. Containing contamination with a fixative will allow future decontamination efforts to be performed in a more controlled manner, therefore reducing the potential for spread of contamination.

Administrative controls include radiological control hold points; contamination limits found in procedures, work packages, and RWPs; dress/undress practices; low dose rate waiting and/or staging areas; and training.

6.0 AIRBORNE RADIOACTIVITY CONTROLS

Air sampling assessments and procedures provide guidance to the Radiological Control Technicians (RCT) regarding air sampling requirements during sediment relocation and removal activities.

Controlling contamination is an essential part of controlling airborne radioactivity concentrations. Controls used to manage airborne radioactivity concentrations during sediment relocation and removal are high-pressure washing of surfaces underwater, and using engineered ventilation to create a negative pressure in the north cask pit to minimize the size of ARAs when needed. By using engineering controls like those mentioned above, minimal respiratory protection will be required during the sediment relocation and removal process.

7.0 SPECIAL TRAINING REQUIREMENTS

Personnel working on the sediment relocation and removal process are required to complete a pre-job and plan of the day briefing. In addition, personnel must receive the following training/qualifications: Radiation Worker II, General Employee Radiological Training/Hanford General Employee Training and Facility Orientation, and the Basin Enhanced Radiation Worker Training. Some personnel will be qualified to wear a respirator, when required.

8.0 CONCLUSION

The sediment relocation and removal work process uses sound ALARA practices and principles. The incorporation of engineered controls, radiation and contamination area controls, and airborne radioactivity controls will ensure that all exposures are maintained ALARA. Exposure estimates are provided in Appendices A and B. Implementation of the engineered and administrative controls results in a dose equivalent estimate of approximately 32.19 person-rem.

9.0 REFERENCES

BHI, 1995, *100-N Basin Stabilization Project As Low As Reasonably Achievable*, BHI-00067, Rev. 1, Bechtel Hanford, Inc., Richland, Washington.

DeMers, J. W., 1997, *In-Progress ALARA Review of 105-N Basin Sediment Relocation Activities*, Internal Memorandum CCN 050823 to RadCon Engineering, Bechtel Hanford, Inc., Richland, Washington.

APPENDIX A

EXPOSURE ESTIMATE FOR SEDIMENT RELOCATION AND REMOVAL

The estimated dose equivalent to be received during sediment relocation and removal is 32.19 person-rem. The work has been divided into major tasks to show the exposure estimate by task.

Task No.: 1

Task Title	Sediment Removal ROSEE Phase and Pump Removal (completed 11/97)
Location	N-Basin
Person Hours	1,202 hours
Estimated Dose Equivalent (Person-rem)	6.02person-rem

Task No.: 2

Task Title	Install and Operate First Generation Airlift (completed 11/97)
Location	N-Basin
Person Hours	500 hours
Estimated Dose Equivalent (Person-rem)	0.81 person-rem

Task No.: 3

Task Title	Install, Operate Maintain New Airlifts (w/socks)
Location	N-Basin
Person Hours	1,087 hours
Estimated Dose Equivalent (Person-rem)	2.74 person-rem

Task No.: 4

Task Title	Sediment Transfer by Sandpiper Pump
Location	N-Basin
Person Hours	1,320 hours
Estimated Dose Equivalent (Person-rem)	7.92 person-rem

Task No.: 5

Task Title	Post Sandpiper Airlift of Debris and Second Sock Upgrade
Location	N-Basin
Person Hours	1010 hours
Estimated Dose Equivalent (Person-rem)	4.94 person-rem

Task No.: 6

Task Title	Removal and Disposal of Filter Socks
Location	N-Basin
Person Hours	325 hours
Estimated Dose Equivalent (Person-rem)	0.69 person-rem

Task No.: 7

Task Title	Sediment Removal and Stabilization for Shipment
Location	N-Basin
Person Hours	2,210 hours
Estimated Dose Equivalent (Person-rem)	9.07 person-rem

Total Hours Planned: 7,654 hours
Total Estimated Dose Equivalent (Person-rem): 32.19 person-rem

APPENDIX B

EXPOSURE ESTIMATE BREAKDOWN

TASK 1: Sediment Removal ROSEE Phase and Pump Removal (Completed 11/97).

Personnel/Operation	Hours	Dose Equivalent Rate (mrem/hr)	Dose Equivalent (person-rem)
D&D Operators	711	5.0	3.56
RCT	178	5.0	0.89
Maintenance	135	5.0	0.68
Supervision	178	5.0	0.89
		Total	**6.02**

D&D = decontamination and decommissioning

TASK 2: Install and Operate First Generation Airlift (Completed 11/97)

Personnel/Operation	Hours	Dose Equivalent Rate (mrem/hr)	Dose Equivalent (person-rem)
D&D Install	380	1.5	0.57
D&D Operate	120	2.0	0.24
		Total	**0.81**

TASK 3: Install, Operate Maintain New Airlifts (w/socks)

Personnel/Operation	Hours	Dose Equivalent Rate (mrem/hr)	Dose Equivalent (person-rem)
D&D Install New Equipment	526	1.5	0.79
D&D Operate	495	2.0	0.99
Maintenance/Repair	60	12.0	0.72
Sock Replacement/Adjustment	6	40.0	0.24
		Total	**2.74**

TASK 4: Sediment Transfer by Sandpiper Pump

Personnel/Operation	Hours	Dose Equivalent Rate (mrem/hr)	Dose Equivalent (person-rem)
D&D Operators	990	7.0	6.93
RCT	330	3.0	0.99
		Total	**7.92**

TASK 5: Post Sandpiper Airlift of Debris and Second Sock Upgrade

Personnel/Operation	Hours	Dose Equivalent Rate (mrem/hr)	Dose Equivalent (person-rem)
D&D Operate Airlift	660	6.0	3.96
RCT Support Operation	220	3.0	0.66
D&D Prep for Sock Upgrade	75	2.0	0.15
D&D Install Sock	25	5.0	0.13
RCT	30	1.5	0.04
		Total	**4.94**

TASK 6: Removal and Disposal of Filter Socks

Personnel/Operation	Hours	Dose Equivalent Rate (mrem/hr)	Dose Equivalent (person-rem)
D&D Set-up and preparation	100	1.5	0.15
D&D Sock Removal and Grouting	25	10.0	0.25
RCT	75	1.5	0.11
Riggers/crane operator	75	2.0	0.15
Supervision/field support	50	0.5	0.03
		Total	**0.69**

TASK 7: Sediment Removal and Stabilization for Shipment

Operation/Personnel	Hours	Dose Equivalent Rate (mrem/hr)	Dose Equivalent (person-rem)
D&D Non-HCA	700	3.5	2.45
D&D NLOP HCA	200	15.0	3.0
RCT	650	1.5	0.98
Rigger	360	4.0	1.44
Crane operator	180	6.0	1.08
Field Support	120	1.0	0.12
		Total	**9.07**

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