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June 10, 1999

FDH-9953935

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Mr. J. M. Augustenborg, Acting Assistant Manager
Waste Management
U.S. Department of Energy
Richland Operations Office
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Dear Mr. Augustenborg:

CONTRACT NUMBER DE-AC06-96RL13200 - SPENT NUCLEAR FUEL SLUDGE TREATMENT PATH FORWARD RECOMMENDATION

Reference: Letter, N. H. Williams, FDH, to E. D. Sellers, RL, "Contract Number DE-AC06-96RL13200, Spent Nuclear Fuel Project, Draft Sludge Treatment Alternatives Analysis," FDH-9951366, dated March 1, 1999.

The Spent Nuclear Fuel (SNF) Project has developed a recommendation for efficient, cost-effective management of the sludge currently stored in the K Basins. The recommendation was developed as a site-level initiative and utilized a senior advisory panel comprised of Project Hanford Management Contract, US. Department of Energy, Richland Operations Office (RL), and U.S. Environmental Protection Agency (EPA) senior managers. Key points of the recommendation include:

- Sludge should be removed from the K Basins on the schedule currently specified in the Tri-Party Agreement Milestones (TPA) M-34-08 and M-34-10.
- Sludge should be placed into interim storage, without initial treatment, at the T-Plant and should be maintained in a retrievable condition, pending final treatment and disposal.
- Treatment and disposal of the sludge should be coordinated with other remote handled transuranic (RH-TRU) waste at the site, in accordance with TPA Milestone M-91-00.

The current baseline chemical sludge treatment process was approved in August 1998. This process would have been capable of treating the sludge for disposal in the Tank Farm double-shell tanks, but several features made it unattractive: high cost, construction of a new single-

purpose facility with a 13-month operating life, and low probability of meeting TPA Milestone schedules.

Further review of sludge treatment alternatives during Fiscal Year 1999 indicated little opportunity for cost reduction or schedule improvement if current treatment and disposal requirements were to be met (Reference). In April, the Sludge Treatment Alternatives Analysis (STAA) report was issued summarizing stand-alone sludge treatment alternatives. Based on that report none of the evaluated treatment alternatives were accepted. Instead, an undefined hybrid approach was incorporated into the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) documentation (Focused Feasibility Study and Proposed Plan for the K Basins Interim Remedial Action) as the preferred alternative for sludge management.

To develop the "hybrid approach" a senior advisory panel was formed in March 1999, to explore combinations of alternatives and to recommend a final solution for sludge management that would meet the CERCLA evaluation criteria and would be completed within the baseline budget and schedule (Reference). This team, supported by SNF technical staff, was comprised as follows:

Mr. W. C. Miller (Team Lead)
Chief Engineer
SNF Project

Mr. T. A. Flament
Vice President, Technical Director
Numatec Hanford Corporation

Mr. R. T. Wilde
Vice President, Deputy General Manager
Waste Management Hanford

Mr. D. R. Sherwood
Hanford Project Manager
EPA

Mr. P. G. Loscoe
Acting Director, Spent Nuclear Fuels Project
RL

Mr. D. J. Washenfelder
Tank Waste Remediation System
Fluor Daniel Hanford - Project Direction

The advisory panel evaluated the feasibility of a number of combinations of storage and treatment alternatives over a two-month period. The panel issued its recommendation (Attachment) to the SNF Project on May 25, 1999. Based on the panel's recommendation the SNF Project proposes the following:

> The SNF sludge should be retrieved from the basins and managed as two separate waste streams and be interim stored at T-Plant. Additionally, it is proposed that the K Basin sludge be managed for treatment with other Hanford waste streams consistent with

TPA Milestone M-91-00 having similar characteristics. One sludge stream would be comprised of canister and fuel wash sludge, which is collected in the knockout pots and settler tanks; the second sludge stream would be comprised of the floor and pit sludge. The canister and fuel wash sludge is expected to include a significant number of metallic uranium fuel fragments, which are pyrophoric, and presents special safety issues. The estimated volume of this sludge is approximately four cubic meters. The floor and pit sludge, with a much larger estimated volume of approximately forty-six cubic meters, consists of less reactive components: windblown sand and rocks, spalled concrete from the walls of basin, iron and aluminum corrosion products, ion exchange resin beads, uranium oxides, and possibly some uranium fuel particles. The sludge would be managed onsite as RH-TRU waste upon exiting the K Basins. Both sludge streams would be transported to T-Plant for interim storage: canister and fuel wash sludge would be stored in vented vessels underwater in the T-Plant fuel pool, and the floor and pit sludge would be stored either in empty cells or on the canyon deck. Although final treatment of the sludge is deferred, during storage at T-Plant the uranium metal component of the sludge will continue to oxidize, resulting in a less reactive stream to handle during final processing. Treatment of the sludge would be integrated into the plans for treatment of the other estimated 2,000 cubic meters of RH-TRU waste located at the Hanford Site.

The applicable requirements of the State of Washington Dangerous Waste Regulations would govern storage of the sludge. Storage requirements for the Toxic Substances Control Act would also be applicable, as the sludge is considered a polychlorinated biphenyl (PCB) remediation waste. A Notice of Construction to the Washington State Department of Health and the EPA would be necessary to comply with the applicable air emission standards during storage. All sludge would be managed as RH-TRU waste. The boundary of the K Basins Interim Remedial Action (i.e., CERCLA requirements) does not cover storage of the sludge at T-Plant.

The sludge would remain in storage until scheduled for treatment with other Hanford Site RH-TRU waste, in accordance with TPA Milestone M-91-00. The schedule would be developed as part of the Project Management Plan for M-91-03, which will be completed by June 30, 2000 (M-91-03, "Submit Hanford Site TRU/TRUM Waste Project Management Plan [PMP] to Ecology Pursuant to Agreement Section 11.5."). Final disposition of the treated sludge would be at the Waste Isolation Pilot Plant or another suitable location, as specified in the M-91-03 Project Management Plan.

The new proposed sludge disposal pathway is expected to reduce overall costs to the SNF Project and the Hanford Site. Major savings are achieved by elimination of a stand-alone sludge treatment facility and instead using a previously planned RH-TRU facility. This approach also enables use of K Basin and T-Plant fuel handling and transport systems, constructed to remove SNF from the K Basins and T-Plant fuel storage basin, for the sludge. The cost of new T-Plant

modifications, sludge container loading systems, permits and safety basis should be well within the current baseline budget. A detailed cost estimate will be developed during conceptual design in FY2000.

The SNF Project requests that you provide your approval for the recommended path forward for the K Basin sludge by June 24, 1999. Upon approval of this recommendation by RL the SNF Project will take the following actions:

- Develop detailed planning for work to be accomplished in FY1999 that supports the new path forward and document in a Baseline Change Request (BCR) to be submitted for approval to RL.

- Develop Memorandum of Understandings (MOUs)/Interface Agreements with the Waste Management Project and other SNF subprojects. An initial MOU between the Waste Management Project and the SNF Project will be completed and signed by both parties by August 1, 1999.

- Develop detailed planning for out-years that will be reflected in the FY2000 Multi-Year Work Plan submittal.

We believe this recommendation is the best course of action for management of the K basins sludge. The integrated treatment of the sludge with other similar waste at the Hanford Site through M-91-00 allows the sludge to be moved away from the river on schedule and is expected to cost less than the baseline chemical treatment alternative. It would also be significantly less than the estimated cost for any of the alternatives evaluated in the STAA.

If you have any questions, please contact me at 373-6307 or Mr. E. W. Gerber of my staff at 376-9356.

Very truly yours,

N. H. Williams, Project Director
Spent Nuclear Fuel Project

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Attachment

FDH-9953935

ATTACHMENT

Senior Management Team Evaluation:
Path Forward Recommendation for SNF Sludge Treatment
May 25, 1999

10 pages (including coversheet)

Senior Management Team Evaluation: Path Forward Recommendation for SNF Sludge Treatment

May 25, 1999

Senior Management Team Evaluation:
Path Forward Recommendation for SNF Sludge Treatment

Summary and Recommendation

The Spent Nuclear Fuel (SNF) sludge treatment project, and the policies, requirements, and constraints associated with it, were reviewed by a senior management team to determine if there was a more cost-effective, technically feasible, path forward for the disposition of the K Basin sludge. Three basic approaches, with various combinations, were evaluated for the explicit purpose of meeting the Tri-Party Agreement (TPA) commitment to remove the sludge from the K Basins: (1) treatment at a throughput rate to support the retrieval schedule; (2) integrated treatment with TPA Milestone M-91-00 that deals with the treatment and disposal of transuranic waste; and (3) interim storage and treatment at a lower throughput in an existing facility.

Based on an analysis of these approaches, the senior management team recommends that the SNF sludge be retrieved from the basins and managed as two separate waste streams and be interim stored at T-plant. Additionally, it is proposed that the K basin sludge be managed for treatment with Hanford waste streams consistent with Tri-Party Agreement Milestone M-91-00 having similar characteristics. One sludge stream will be comprised of canister and fuel wash sludge, which is collected in the knockout pots and settler tanks; the second sludge stream will be comprised of the floor and pit sludge. The canister and fuel wash sludge is expected to include a significant number of metallic uranium fuel fragments, which are pyrophoric, and fuel corrosion products. The estimated nominal volume of this sludge is ~ 4 m^3. The floor and pit sludge, with a much larger estimated nominal volume of ~ 46 m^3, primarily consists of less reactive components: windblown sand and rocks, spalled concrete from the walls of basin, iron and aluminum corrosion products, ion exchange material, uranium oxides, and possibly some uranium fuel particles. The sludge will be managed onsite as remote handled (RH) transuranic (TRU) waste upon exiting the K Basins. Both sludge streams will be transported to T-Plant for interim storage: canister and fuel wash sludge will be stored in vented vessels underwater in the T-Plant fuel pool, and the floor and pit sludge will be stored either in empty cells or on the canyon deck. Treatment of the sludge material will be integrated into the plans for treatment of the other estimated 2000 m^3 of RH-TRU waste located at the Hanford site.

The recommended path forward for the SNF sludge allows the sludge to be moved away from the river on schedule, achieves efficiencies through integration with similar Hanford waste streams to be processed as part of the M-91-00 milestone, and is expected to cost significantly less than the baseline chemical pretreatment alternative. Although final treatment of the sludge could be deferred, the uranium metal component of the sludge will continue to corrode during storage at T-Plant, resulting in a less reactive stream to handle during final processing.

Background

The current SNF Project baseline assumes chemical treatment of the sludge material to produce a waste stream that could be accepted by the Hanford Tank Farm and ultimately treated by vitrification for disposal.

A recently completed Sludge Treatment Alternatives Analysis (Pearce et al. 1999) evaluated six treatment and disposal options for handling, managing, and disposing of the K Basin sludge to determine if a better alternative could be identified due to uncertainties in the cost of the baseline approach. The results from the analysis show that, for the requirements and constraints currently imposed, the most effective treatment alternative is a chemical process similar to what is currently in the baseline (i.e., chemical pretreatment). However, there are risks that the baseline approach may not meet the baseline schedule. The analysis concluded based on preliminary investigations, that the Cold Vacuum Drying (CVD) facility would not be adequate to house the sludge treatment process. Therefore, a new stand-alone treatment facility was assumed for each of the process alternatives investigated. The results of this study indicated the potential for large cost impacts to the SNF Project baseline if no simpler path forward was identified.

Consequently, in March 1999, a senior management team was assembled to review the sludge treatment process from receipt of sludge through final disposal. This review looked at the current set of policies, requirements, constraints, and technologies imposed or considered for the SNF sludge treatment and disposal process. The members of the management review team were the following:

W. C. Miller (Team Lead)	Chief Engineer, SNF Project
T. A. Flament	Vice President, Technical Director Numatec Hanford Corporation
P. G. Loscoe	Acting Director, Spent Nuclear Fuel Project Richland Operations Office
D. R. Sherwood	Hanford Project Manager U. S. Environmental Protection Agency
D. J. Washenfelder	Tank Waste Remediation System Fluor Daniel Hanford - Project Direction
R. T. Wilde	Vice President, Deputy General Manager Waste Management Hanford

There are many separate waste streams onsite that need to be treated and disposed of as part of the Hanford cleanup effort. Waste Management Hanford (WMH) is currently responsible for the treatment and disposal of a number of these waste streams. The planning and implementation of this work is being performed as part of Tri-Party Agreement milestone M-91-

00, which reads "Complete the acquisition of new facilities, modifications of existing facilities, and/or modification of planned facilities necessary for storage, treatment/processing, and disposal of all Hanford site TRU/TRUM, LLMW, and GTC3." Efficiencies associated with treating similar wastes at Hanford will be increased if disposition of the K Basin sludge is coordinated with M-91.

Regulatory Framework

The K Basins sludge will be designated as a mixed waste. The mixed waste designation is based on total concentrations of cadmium, chromium, and lead, which are included on the toxicity characteristic list (*Washington Administrative Code* [WAC] 173-3-3-090[8][c]). The sludge has not been analyzed using the Toxicity Characteristic Leaching Procedure (TCLP), so leachable concentrations of these metals are not known. However, making the designation based on total concentrations is conservative (DOE-RL 1999).

The K Basins sludge will be regulated as a polychlorinated biphenyl (PCB) remediation waste under the *Toxic Substances Control Act* (TSCA) based on the detection of PCBs in the KE Basin floor and pit sludge (DOE-RL 1999).

Approaches Considered by the Senior Management Team for Path Forward Recommendation

The three basic approaches considered by the senior management team are summarized below. All approaches must meet the current Tri Party Agreement commitments for removing the sludge from the K Basins.

1. Treatment at a throughput rate to support the retrieval schedule

   This approach would provide a facility to treat all the sludge in thirteen months. The sludge would be treated as it was removed from the K basins. A new stand-alone facility was assumed to be required by the Sludge Treatment Alternatives Analysis (Pearce et. al. 1999). The results predicted a large cost impact to the SNF Project. There was also a question of whether the facility could be completed in time to support the existing baseline schedule.

2. Integrated treatment with M-91-00

   In this approach, the K Basin sludge would be retrieved from the basins and managed as two separate waste streams and integrated with Hanford waste streams under M-91-00 having similar characteristics. One sludge stream will be comprised of canister and fuel wash sludge, which is collected in the knockout pots and settler tanks; the second sludge stream will be comprised of the floor and pit sludge. The canister and fuel wash sludge is expected to include a significant number of metallic uranium fuel fragments, which are pyrophoric, and fuel corrosion products. The estimated nominal volume of this sludge is ~ 4 m^3. The floor and pit sludge, with a much larger estimated nominal volume of ~ 46 m^3, primarily consists of less reactive components: windblown sand and rocks, spalled concrete from the

walls of basin, iron and aluminum corrosion products, ion exchange material, uranium oxides, and possibly some uranium fuel particles. The sludge will be managed onsite as remote handled (RH) transuranic (TRU) waste upon exiting the K Basins. Both sludge streams will be transported to T-Plant for interim storage: canister and fuel wash sludge will be stored in vented vessels underwater in the T-Plant fuel pool, and the floor and pit sludge will be stored either in empty cells or on the canyon deck. An alternative for the floor and pit sludge is that it could also be stored in the T-Plant pools. Treatment of the sludge material will be integrated into the plans for treatment of the other estimated 2000 m^3 of RH-TRU waste located at the Hanford site. Based on the characteristics of the canister and fuel wash sludge it may require more extensive treatment than the floor and pit sludge.

3. Interim storage and treatment at a lower throughput in an existing facility, i.e., hot cells at WESF

   This approach would include sludge treatment on a schedule based on the size of a treatment system that could be installed within an existing facility. Removing the sludge from the basins would meet the current TPA schedule commitment but would also require interim storage until all sludge could be processed. The sludge would be treated to meet TWRS criteria, and stored in DSTs or treated to meet the WIPP waste acceptance criteria and sent to WIPP. For this approach, it is not known if the infrastructure upgrades and treatment system that would be put in place at WESF could be used again by another program (e.g., M-91).

Path Forward Recommendation

After considering the three approaches, the senior management team recommends interim storage at T-Plant and integrated treatment with M-91-00. The basis for the recommendation is the following:

1. Storage at T-Plant with minimal or no processing until the sludge and metallic particles can be processed in shared facilities with similar Hanford material was preferred for cost and schedule reasons.
2. Costs to meet TWRS acceptance criteria, the basis for original sludge studies, were excessive. It appears the K Basin sludge and other Hanford waste of similar type can be disposed with appropriate protection of the environment without meeting TWRS criteria. The criticality, metal particle size, alkaline pH, and similar acceptance criteria imposed by the TWRS Authorization Basis envelope of parameters would result in significant costs that were not offset by prospective savings in production of waste for final disposal.
3. Storage at T-Plant and processing with M-91-00 wastes offers the potential for lowest life cycle cost and shared use of facilities for processing among several projects.

Advantages

- The sludge is moved away from the river on schedule, which lowers the risk to the public.

- Similar Hanford waste streams under M-91-00 management have been identified in terms of waste characteristics and regulatory status. Integrating the sludge with M-91-00 waste streams will be a more efficient method of treating the sludge and related waste streams for the Hanford site. Also, M-91-00 will be a WIPP certified program.

- The schedules for M-91-00 implementation and sludge removal from the basins are concurrent. Specifically, the sludge is scheduled to be removed from the basins by FY2005. The schedule for M-91-00 is to have a facility ready to start treating waste by FY2005.

- T-Plant is being considered for housing the treatment systems for the M-91 waste streams. However, even if T-Plant is not selected for the M-91 work scope, integrating the treatment of K-Basin sludge material with other related waste streams is still more cost effective for the Hanford site than the other approaches.

- During storage at T-Plant, uranium metal will continue to corrode, ultimately resulting in a less reactive stream to handle during final processing.

- The SNF Project currently has the responsibility to modify the T-Plant fuel loadout system to remove the shippingport fuel in its existing baseline. This system can also be used to support the off loading of the sludge containers.

Disadvantages

The only disadvantage with this path forward is that while it provides a near-term solution for moving the sludge away from the river, the cost and schedule for final treatment and disposal are deferred. However, the baseline process - transfer to a TWRS double shell tank - also defers final treatment and disposal.

Considerations for Executing the Recommended Approach

The following areas should be considered during conceptual design for sludge treatment and disposal: Programmatic, Packaging, Transport, and Storage. These items represent potential uncertainties associated with the recommended approach.

Programmatic

- The division of responsibility between WMH and SNFP needs to be determined and agreed to by both parties.
- Interfaces must be established within the SNF subprojects that reflect the technical and scope changes.
- SNM accountability and safeguards requirements need to be determined

- The Department of Energy, the Environmental Protection Agency, and the Washington State Department of Ecology will need to coordinate the incorporation of SNF sludge into Milestone M-91-00.

Packaging

Due to the expected differences in the characteristics of the sludge, two packages should be considered, one for the canister and fuel wash sludge, and another for the floor and pit sludge. It is expected that larger quantities of floor and pit sludge could be placed in a container for safe transport and storage. Use of existing packages and package designs should be maximized where cost effective. More analysis is required to determine the optimum solution for packaging for transport and storage.

Transport

The existing transport system for fuel movement should be used if possible. Additional gas generation analysis is needed to select/design an appropriate transport system.

Storage

The T-Plant facility will be modified as required to support interim storage. These modifications are envisioned as only those required to bring T-Plant into RCRA compliance for a storage mission. Storage will be in two locations within the T-Plant facility. The existing T-Plant pool may need to be upgraded to store the canister and fuel wash sludge. The existing cells or portable shielding may require upgrading to store the floor and pit sludge.

Shippingport Fuel currently stored in the T-Plant pool will be moved to the Canister Storage Building (CSB) by a separate effort within the SNF Project. The loadout system at T-Plant is being modified to support this effort. This modification will also need to be coordinated to support sludge offloading.

Other modifications of the T-Plant facility may be required to support interim storage. The following items should be considered for further analysis during conceptual design:

- Building is 55 years old
- Hazard category of facility
- Safety Analysis Report (SAR) revisions
- Heating, Ventilation, and Air Conditioning (HVAC) Systems
- Cask loadout
- Criticality alarms
- Regulatory permits
- Heat and gas generation of the sludge.

Costs

The cost for interim storage of the SNF sludge is expected to be less than or equal to the existing SNF Project baseline. This will be verified when a new baseline has been established for this path forward recommendation. Planning has been initiated for M-91 to provide the treatment facility and dispose of the waste.

Conclusion

This recommended path forward identified an acceptable approach for interim storage of K Basin sludge with manageable risks. This approach is expected to be within the currently established funding constraints, and benefits from integrating it with an already planned treatment facility to be constructed and operated to fulfill the TPA commitments identified in the M-91-00 milestone sequence.

References

DOE-RL, 1999, *Draft Focused Feasibility Study for the K Basins Interim Remedial Action,* DOE/RL-98-66 Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, EPA, and DOE, 1996, *Hanford Federal Facility Agreement and Consent Order, fifth and Sixth Amendment February 1996,* Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington

Pearce, K. L., G. A. Whyatt, A. J. Schmidt, J. D. Hoover, and C. A. Petersen, 1999, *Sludge Treatment Alternatives Analysis.* HNF-4097, Rev. 0. prepared by Numatec Hanford Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.

Senior Management Team Evaluation:
Path Forward Recommendation for SNF Sludge Treatment

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Subject: CONTRACT NUMBER DE-AC06-96RL13200 – SPENT NUCLEAR FUEL SLUDGE TREATMENT PATH FORWARD RECOMMENDATION

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