JUL 31 2000 (24) S

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ENGINEERING DATA TRANSMITTAL

Page 1 of ____

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2. To: (Receiving Organization)	3. From: (Originating Organization)	4. Related EDT No.:
Distribution	Retrieval System Development	NA
5. Proj./Prog./Dept./Div.:	6. Design Authority/Design Agent/Cog. Engr.:	7. Purchase Order No.:
RPP/Retrieval System Development	W.L. Willis	NA
8. Originator Remarks:		9. Equip./Component No.:
For approval and release.		NA
		10. System/Bldg./Facility:
		Tk AY101&102,AZ101&102
11. Receiver Remarks:	11A. Design Baseline Document? ☐ Yes ☒ No	12. Major Assm. Dwg. No.:
		NA
		13. Permit/Permit Application No.:
		NA
		14. Required Response Date:
		NA

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Approval Designator	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	RPP-6536	--	0	Decision Document for	NA	1	1	-
				Heat Removal from		2		
				High-Level Waste Tanks				

16. KEY

Approval Designator (F)	Reason for Transmittal (G)		Disposition (H) & (I)	
E, S, Q, D OR N/A (See WHC-CM-3-5, Sec. 12.7)	1. Approval 2. Release 3. Information	4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment	4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION
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		Design Authority				1	1	A.F. Choho	Choho	7/18/00	
		Design Agent									
1	1	Cog. Eng. W.L. Willis		7/31/00							
1	1	Cog. Mgr. P.J. Certa	Paul J. Certa	7/31/00							
		QA									
		Safety									
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18. W.L. Willis — Signature of EDT Originator — Date 7/31/00

19. Authorized Representative for Receiving Organization — Date 7/31/00

20. Paul J. Certa 7/31/00 — P.J. Certa — Design Authority/ Cognizant Manager — Date

21. DOE APPROVAL (if required)
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☐ Approved w/comments
☐ Disapproved w/comments

Decision Document for Heat Removal from High-Level Waste Tanks

W. L. Willis
Numatec Hanford Corporation
Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-99RL14047

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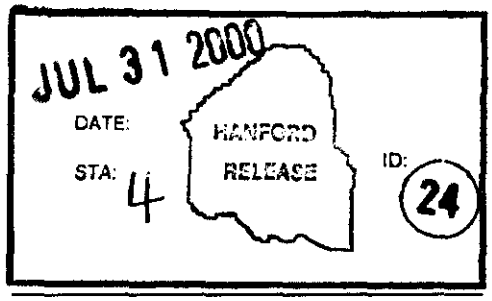
Key Words:
Retrieval, mixer pump, sludge, fluffed sludge, fluffing factor, thermal analysis, GOTH_SNF, settling, waste temperature

Abstract: This document establishes the combination of design and operational configurations that will be used to provide heat removal from high-level waste tanks during Phase 1 waste feed delivery to prevent the waste temperature from exceeding tank safety requirement limits. The chosen method--to use the primary and annulus ventilation systems to remove heat from the high-level waste tanks--is documented herein.



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RPP-6536
Revision 0

Decision Document for Heat Removal from High-Level Waste Tanks

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

CH2MHILL
Hanford Group, Inc.
Richland, Washington

Contractor for the U.S. Department of Energy
Office of River Protection under Contract DE-AC06-99RL14047

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Decision Document for Heat Removal from High-Level Waste Tanks

Prepared by:
W. L. Willis
Numatec Hanford Corporation
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Date Published
July 2000

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

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Office of River Protection under Contract DE-AC06-99RL14047

DECISION DOCUMENT FOR HEAT REMOVAL

FROM HIGH-LEVEL WASTE TANKS

DECISION-MAKER APPROVAL

07/31/00

R. A. Dodd, Acting Manager
Double-Shell Tank and Waste Feed Delivery Project

Date

DECISION DOCUMENT FOR HEAT REMOVAL

FROM HIGH-LEVEL WASTE TANKS

DECISION SUPPORT BOARD CONCURRENCE

Your signature indicates that you agree that the description given in Section 5.0 of this document is a fair and complete representation of the recommendation and that you agree with the recommendation.

G. P. Duncan, Project Definition Operations — 7-17-00 — Date

A. F. Choho, Retrieval Engineering — 7-18-00 — Date

R. S. Popielarczyk, Chief Engineer — 7/26/00 — Date

7/26/00 for CEL

C. E. Leach, Nuclear Safety and Licensing — 7/26/00 — Date

CONTENTS

1.0 STATEMENT OF THE PROBLEM

This decision considers the following problem:

> What is the preferred combination of design and operational configurations to provide heat removal from high-level waste tanks during Phase 1 feed delivery to prevent the waste temperature from exceeding tank safety requirement limits as specified in the technical safety requirements (HNF-SD-WM-TSR-006, *Tank Waste Remediation System Technical Safety Requirements*)?

The temperature limits in the technical safety requirements are imposed to avoid a tank bump accident, which might result in the release of radioactive material onsite. The technical safety requirements includes a safety limit, SL 2.1.1, which states:

> "The WASTE temperature shall be ≤250°F."

The technical safety requirements also include a related limiting condition for operation, LCO 3.3.2, which states:

> "The WASTE temperature shall be either:
> (1) ≤195 °F in all levels of the WASTE
> OR
> (2) ≤195 °F in the top 15 ft of the WASTE
> AND
> ≤215 °F in the WASTE below 15 ft."

For further discussion of the problem, see HNF-4433, *Alternatives Generation and Analysis for Heat Removal from High-Level Waste Tanks*, Section 1.0.

2.0 DATE OF SELECTION

An interim decision was reached on March 2, 2000, and documented on March 20, 2000, in Memorandum 79C00-00-012, *High-Level Waste Heat Removal Interim Decision,* sent from G. P. Duncan to A. F. Choho (Duncan 2000). The date of the final decision is the date that the decision-maker signs this document.

3.0 DECISION-MAKER

The decision-maker is R. A. Dodd, Acting Manager of Double-Shell Tank and Waste Feed Delivery Project.

4.0 DECISION ACTION OFFICER

The decision action officer is A. F. Choho, Manager, Retrieval Engineering.

5.0 SELECTED ALTERNATIVE

The decision-maker selected the following alternative for heat removal from high-level waste tanks:

- Primary Ventilation Systems
  - The minimum required once-through flow rate of noncooled air through the headspaces of Tanks 241-AY-101, 241-AY-102, 241-AZ-101, and 241-AZ-102 will be 0.24 m^3/s (500 ft^3/min) per tank when undergoing mixing and settling.
  - The primary ventilation systems—specifically, the equipment performing the heat-removal function—for each of the four high-level waste tanks are assumed to be designated safety significant for the tank bump accident.
- Annulus (Secondary) Ventilation Systems
  - The minimum required once-through flow rate of noncooled air through the cooling channels (slots) of Tanks 241-AY-101, 241-AY-102, 241-AZ-101, and 241-AZ-102 is 0.40 m^3/s (850 ft^3/min) per tank; the nominal design flow rate is 0.47 m^3/s (1,000 ft^3/min).
  - The annulus ventilation systems—specifically, the equipment performing the heat-removal function—for each of the four high-level waste tanks are assumed to be designated safety significant for the tank bump accident.

The selected alternative is discussed in HNF-4433, Sections 3.0 and 4.0.

The decision to use the ventilation systems for heat removal from high-level waste tanks was driven primarily by the following considerations:

- No other alternative was shown to be capable of safely and reliably maintaining the waste to within the temperature limits in the technical safety requirements.
- Operation of the ventilation systems to control waste temperature meets the fundamental objectives of the Waste Feed Delivery Program and presents little risk to the successful completion of the waste feed delivery mission.

The basis for this decision is discussed further in the executive summary of HNF-4433.

6.0 SCREENING CRITERIA

Several potential solutions to the heat removal problem were posed and then screened against the following requirements and constraints:

- The waste must be maintained within the temperature limits imposed by the technical safety requirements.
- The primary ventilation system must maintain the tank dome pressure below atmospheric pressure.
- The annulus ventilation system must operate within the tank pressure design limits.
- Heat removal systems must be capable of removing the bounding heat load and limiting the maximum temperature in the tank, including the temperature in the settled sludge.
- An acceptable alternative must be capable of being made safety significant.

Only one alternative (use of the primary and annulus ventilation systems for heat removal) satisfied the requirements and constraints.

7.0 FUNDAMENTAL OBJECTIVES OF WASTE FEED DELIVERY

Following screening, the single remaining alternative was compared to the following fundamental objectives of waste feed delivery:

- Maximize public, worker, and environmental safety
- Maximize regulatory compliance
- Minimize life-cycle cost
- Maximize the chances of success of the waste feed delivery mission.

The alternative was found to satisfy all of the fundamental objectives. In addition, an assessment showed that the risks associated with using the ventilation systems to control temperature were manageable and acceptable.

8.0 ASSUMPTIONS

The following were the most important assumptions used in this decision:

- The GOTH_SNF thermal modeling results accurately reflect the tank waste temperature profiles under the conditions assumed.
- The bounding temperature in the settled sludge is produced in Tank 241-AZ-102 when the tank is mixed and the solids are allowed to resettle to a fluffed condition.

Additional information on the assumptions, constraints, and requirements is given in HNF-4433, Section 2.0.

9.0 ALTERNATIVES REJECTED

The following alternatives were considered and ultimately rejected:

- Use the airlift circulators to keep the solids in suspension
- Use heat exchangers to cool the waste
- Use mixer pumps to keep the solids in suspension
- Delay the decision pending the final results of the Tank 241-AZ-101 mixer pump test[1]
- Alter the safety limits for temperature specified in the technical safety requirements.

A description of the rejected alternatives and an explanation of why each was rejected are provided in HNF-4433, Section 3.0

10.0 ADDITIONAL AUTHORIZATION BASIS CONSIDERATIONS

The result of the interim decision reached in March 2000 and the underlying assumptions relative to the authorization basis that led to the final decision are accurately documented herein. However, in response to direction from the Office of River Protection, the authorization basis continues to evolve relative to the accident of concern—the tank bump accident. Ongoing authorization basis amendments related to the tank bump accident that may have an impact on this decision are described in subsequent paragraphs.

The tank bump accident has been reanalyzed for the safe-storage mission, and an authorization basis amendment reflecting this reanalysis was submitted to the Office of River Protection on June 30, 2000 (Bratzel and DeLozier 2000). If approved, this authorization basis amendment will reduce the onsite radiological consequences for the tank bump accident from the 250 rem reflected in the current final safety analysis report (HNF-SD-WM-SAR-067, *Tank Waste Remediation System Final Safety Analysis Report*) to 5 rem and reduce the onsite toxicological dose by approximately 99 percent. The new radiological dose is equal to the onsite risk evaluation guideline, and the new toxicological dose is above the risk evaluation guideline of 1.

Reanalysis of the tank bump accident for waste feed delivery operations, applying methodologies similar to those used for the safe-storage case, is ongoing and should be completed by the end of July. Preliminary results indicate that the consequences of the safe-storage case will bound the waste feed delivery case. Control decision meetings will be held soon after the analysis is completed. Although the waste feed delivery tank bump accident is expected to have lower consequences than the safe-storage tank bump accident, the radiological consequences probably

[1] While the results of the mixer pump test are extremely valuable, it was determined in HNF-4433 that the results would not change the outcome of the alternatives generation and analysis.

will equal a significant percentage of the risk guidelines and the toxicological consequences still may exceed the guidelines. Therefore, it is reasonable to assume that some technical safety requirement controls will be selected to prevent this accident. The current limiting condition for operation on double-shell tank waste temperature (LCO 3.3.2) is a highly effective, low-cost control. Continued application of LCO 3.3.2 likely will be selected as the primary means for preventing tank bump accidents during waste feed delivery operations. Because of the reduced consequences and because the tank bump accident is slow to develop, the most conservative analyses indicate that in the absence of any primary or annulus ventilation it would take a minimum of 50 days for the waste to reach saturation temperature. Therefore, the ventilation systems probably will not be designated as safety significant.

Although the authorization basis probably will not prescribe how to control waste temperature, this should not affect the decision that use of the primary and annulus ventilation systems is the preferred choice of temperature control from an operational standpoint.

11.0 REFERENCES

Bratzel, D. R., and M. P. DeLozier, 2000, *Submittal of Authorization Basis Amendment for Re-analysis of the Tank Bump Accident to Meet Performance Incentive Number ORP2.1.1, Revision 1, "Authorization Basis Management Process Efficiency Improvement," Section 3, Standard IID., and Section 4, Standard II.D*, (Letter CHG-0003436 to R. T. French, Office of River Protection, dated June 29), CH2M HILL Hanford Group, Inc., Richland, Washington.

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HNF-4433, 2000, *Alternatives Generation and Analysis for Heat Removal from High-Level Waste Tanks*, Rev. 0, Numatec Hanford Corporation for CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-SD-WM-SAR-067, 2000, *Tank Waste Remediation System Final Safety Analysis Report,* Rev. 1-I, CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-SD-WM-TSR-006, 1999, *Tank Waste Remediation System Technical Safety Requirements,* Rev. 0T, Fluor Daniel Hanford, Inc., Richland, Washington.

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