Stk #4 (15)
JUL 25 1998

ENGINEERING DATA TRANSMITTAL

Page 1 of 1

1. EDT 624761

2. To: (Receiving Organization)	3. From: (Originating Organization)	4. Related EDT No.:
Distribution	TWRS Projects/SST Retrieval	n/a
5. Proj./Prog./Dept./Div.:	6. Design Authority/ Design Agent/Cog. Engr.:	7. Purchase Order No.:
W-320 TWRS/TCPN # D2991	JW Bailey, NHC	n/a
8. Originator Remarks: Document issued for review and approval.		9. Equip./Component No.: n/a
		10. System/Bldg./Facility: 241-C-106
11. Receiver Remarks: 11A. Design Baseline Document? [ ] Yes [X] No		12. Major Assm. Dwg. No.: n/a
		13. Permit/Permit Application No.: n/a
		14. Required Response Date: 24 July 1998

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	HNF-3115	-	0	Project W-320 WRSS PCP/Procedure Implementation Verification	NA			-

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
(See Approval Designator for required signatures)

(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN
1	1	Design Authority	JW Bailey	7/25/98	S2-48
		Design Agent			
1	1	Cog.Eng	JW Bailey	7/25/98	S2-48
1	1	Cog.Mgr.	JW Lentsch	7/25/98	S2-48
		Env.			

(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN
1	1	PA Young	PA Young	7/25/98	S2-48

18. JW Bailey 7/25/98
Signature of EDT Originator / Date

19. PA Young 7/25/98
Authorized Representative for Receiving Organization / Date

20. JW Lentsch 7/25/98
Design Authority/ Cognizant Manager / Date

21. DOE APPROVAL (if required) Ctrl. No.
[ ] Approved
[ ] Approved w/comments
[ ] Disapproved w/comments

BD-7400-172-2 (05/96) GEF097

Project W-320 WRSS PCP/Procedure Implementation Verification

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U.S. Department of Energy Contract DE-AC09-96RL13200

EDT/ECN: 624761 UC: 506
Org Code: 8C452 Charge Code: D2991/HANA0600
B&R Code: EW3130010 Total Pages: 44 (JWB 7/25/98

Key Words: W-320, Sluicing, Tank 241-C-106, Tank 241-AY-102, WRSS, Tank Waste Remediation System, Process Control Plan.

Abstract: This document provides verification that the methodology for the safe retrieval of high-heat waste from tank 241-C-106 as specified in the WRSS Process Control Plan HNF-SD-WM-PCP-013, Revision 1, has been adequately implemented into Tank Waste Remediation System (TWRS) operational procedures.

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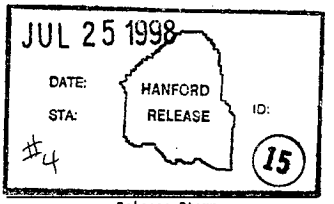

Janis Braden
Release Approval Date Release Stamp

Approved for Public Release

Section and Page Number of HNF-SD-WM-PCP-013	Requirement or Initiating Statement	Implementing Procedure or Document	Comments
2.0, 2-1	Material balance procedures will provide an initial estimate of the high-heat solids transferred from tank 241-C-106 to tank 241-AY-102 during the course of the WRSS operation.	HNF-SD-WM-PROC-021, "*TWRS PROCESS ENGINEERING INSTRUCTION MANUAL*", section 23 (Material Balance)	The material balance procedure **TO-320-003**,"*WASTE RETRIEVAL SLUICING SYSTEM MATERIAL BALANCE*" was not developed as a means to estimate transferred solids. This procedure is used to provide an indication of waste leakage based on tank waste level measurements.
2.0, 2-1	The in-tank temperature trends of the remaining waste and the cooling performance of the ventilation system will be monitored and the data will be used to develop an estimate of the heat load in the tank.	In-tank tank temperature data will be managed and to some extent processed via HNF-2318, Revision 0, "*MANAGEMENT OF DATA FOR TANK 241-C-106 RETRIEVAL*". Ventilation and Chiller performance are evaluated using primarily C-Farm Rounds acquired data.	N/A
3.2.1, 3-12	The sludge in tank 241-C-106 is to be cooled before sluicing startup to prevent a potential steam release event during early stages of sludge retrieval operations.	Procedure **T0-320-005**, "*WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL*", section 4.3.2, identifies the need to sub-cool 241-C-106 waste prior to sluicing. Procedure **T0-320-001**, "*OPERATE TK-241-C-106 HVAC CHILLER*" provides specific instruction for chiller operation.	N/A
3.2.1, 3-12	The more restrictive limit of Administrative Control (AC) 5.26 requires cooling the tank 241-C-106 sludge to its wintertime temperature (FDH 1998b). Wintertime temperatures are achieved when the waste is cooled until the temperature of thermocouple 1 on the riser 8 thermocouple tree reaches 64 °C (148 °F) (Bander et al. 1996).	Procedure **T0-320-005**, "*WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL*", section 4.3.2.1, identifies the need to sub-cool 241-C-106 waste to less than or equal to 148°F.	N/A
3.2.1, 3-13	Sludge cooling is accomplished by operating the tank 241-C-106 exhauster (296-P-16) to draw air through the inlet filter system.	Sludge cooling is achieved using procedures **T0-320-001**, "*OPERATE TK-241-C-106 HVAC CHILLER*", and **TO-060-050**, "*OPERATE 296-P-16 EXHAUSTER*"	N/A
3.2.1, 3-13	The WRSS chiller skid supplies a chilled propylene glycol/water solution to the intake air cooling coil (CC-1361) to cool the air stream to approximately 4 °C (40 °F).	Procedure **TO-060-050**, "*OPERATE 296-P-16 EXHAUSTER*" data sheet identifies the functional range for temperature indicator TI-1362, "COOLING COIL DISCHARGE AIR TEMP." as 34 to 50 °F	N/A
3.2.1, 3-13	As seen in Figure 3-5, the startup condition of tank 241-C-106 needs to be established before beginning supernatant temperature equalization operations.	The startup condition as required prior to temperature equalization is illustrated in procedure **T0-320-005**, "*WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL*" as FIGURE 1 – SLUICING ACTIVITIES TIME-PHASED LOGIC, pg. 79 of 7/17/98 issue.	Startup logic is also summarized in HNF-2955, "*WRSS OPERATIONAL STARTUP PLAN*"

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3.2.2.1, 3-13	The temperatures in tanks 241-C-106 and 241-AY-102 are to be monitored for a period of not less than 30 days before the start of sluicing operations.	Procedure **T0-320-005, "*WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL*"** identifies the 30 day requirement in section 4.3.7.1, bullet number three.	N/A
3.2.2.1, 3-13	Tank 241-C-106 temperature measurements will be obtained from thermocouple trees 8 and 14.	***Data Management Plan Document HNF-2318, Revision 0,*** identifies the availability of temperature data from thermocouple trees in risers 8 and 14 via the TMACS.	The process control plan statement should be clarified to indicate risers 8 and 14 as opposed to TC trees 8 and 14.
3.2.2.1, 3-13 3.2.2.1, Table 3-9, 3-14 Included in Appendix A.	The tank 241-C-106 and Table 3-9 thermocouple measurements, which make up the pre-sluicing thermal baseline, are compared to the project thermal analyses to ensure that the temperatures of the tanks are consistent with the predicted temperatures.	All thermocouples required in table 3-9 are available on the DAS or TMACS. Instruction on the DAS use is provided by procedure **TO-320-004, "*OPERATE WRSS DATA ACQUISITION SYSTEM*"**.	N/A
3.2.2.1, 3-13	Because the actual performance of both the 296-P-16 exhauster with inlet air cooling and the tank 241-AY-102 ventilation systems will be determined during the pre-sluicing operations, the project thermal models will also be benchmarked as part of this baselining activity.	Thermal model baselining and benchmarking efforts are included in the Project W-320 schedule. Initial ventilation/cooling data for the 296-P-16 exhauster / chiller combination became available in early July 1998.	N/A
3.2.2.2, 3-16	Gas release rates are determined directly by monitoring the hydrogen concentration in the headspaces of both tanks using installed standard hydrogen monitoring systems (SHMS) and by measuring the ventilation rates.	SHMS data for 241-AY-102 is available from the DAS (procedure **TO-320-004, *"OPERATE WRSS DATA ACQUISITION SYSTEM"***) and through rounds **procedure TF-OR-AYAZ-D, *"AY AND AZ TANK FARMS DAILY ROUNDS"***. SHMS data for 241-C-106 is available through rounds procedure **TF-OR-EF-C-D, *"C, CR TANK FARMS AND 244-A DCRT LIFT STATION DAILY ROUNDS"***. Tank 241-AY-102-exhaust rate is available as a DAS output. Tank 241-C-106-exhaust rate is available through rounds procedure **TF-OR-WRSS-C-1, *" C-FARM WRSS EQUIPMENT ROUNDS"*** and TMACS.	N/A
3.2.2.2, 3-16 Table 3-10, 3-17 Included in Appendix A.	As specified in the *Tank Waste Remediation System Basis for Interim Operation* (FDH 1998a), a presluicing flammable gas baseline will be established for both tanks 241-C-106 and 241-AY-102.	The required SHMS vent flow identified in Table 3-10 are available **for 241-AY-102 is available from the DAS (procedure** TO-320-004, ***"OPERATE WRSS DATA ACQUISITION SYSTEM"*) and through rounds** procedure TF-OR-AYAZ-D, *"AY AND AZ TANK FARMS DAILY ROUNDS"*. **SHMS data for 241-C-106 is available through rounds procedure** TF-OR-EF-C-D, *"C, CR TANK FARMS AND 244-A DCRT LIFT STATION*	N/A

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		DAILY ROUNDS". **Tank 241-AY-102-exhaust rate is available as a DAS output. Tank 241-C-106-exhaust rate is available through rounds procedure** TF-OR-WRSS-C-1," *C-FARM WRSS EQUIPMENT ROUNDS"* and TMACS. Grab samples are obtained from SHMS cabinets using procedure **TO-080-420,** " *PEFORM VAPOR GRAB SAMPLES IN THE STANDARD HYDROGEN MONITORING SYSTEMS*" ENRAF surface level measurements are obtained using procedure **TO-320-004,** *"OPERATE WRSS DATA ACQUISITION SYSTEM"* and TMACS.	N/A
3.2.2.2, 3-18	To help reduce the uncertainty in the flammable gas baseline, grab samples from the tank dome space will be taken using the SHMS.	Vapor grab necessary to support the hydrogen gas baslining effort will be collected using CPO procedure **TO-080-420,** " *PEFORM VAPOR GRAB SAMPLES IN THE STANDARD HYDROGEN MONITORING SYSTEMS*"	N/A
3.2.2.2, 3-18 Table 3-10, 3-17 Included in Appendix A.	The grab samples will be analyzed for the constituents listed in Table 3-10 and argon (Ar) using high-resolution mass spectrometry.	The analyses of SHMS grab samples will be conducted a Pacific Northwest National Laboratory(PNNL) established procedures specific to the data requirements identified in table 5.10	N/A
3.2.3, 3-18	For tank 241-AY-102, the limit for waste solution temperatures <52 °C (125 °F) is ≤5.6 °C (10 °F) per hour. The tank 241-C-106 transient temperature limit of ≤11 °C (20 °F) per day is independent of waste temperature.	Procedure **TO-320-006,** *"TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS"* section 5.2 identifies step necessary to equalize solution temperatures in tanks 241-C-106 and 241-AY-102 prior to sluicing. It is this temperature equalization that will prevent exceeding the imposed transient thermal limits once sluicing commences.	N/A
3.2.3, 3-18	If the initial temperature difference between the supernatant liquids exceeds 11 °C (20 °F), a number of small liquid transfers from tank 241-AY-102 to tank 241-C-106 and back to tank 241-AY-102 will be required to equalize the tank liquids temperatures.	Procedure **TO-320-006,** *"TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS"* contains conditional statements in sections 5.2.38 and 5.2.39 that direct the operator to pursue multiple liquid transfers until temperature equalization is achieved within 11°C.	N/A
3.2.3, 3-18	The sluice pumping system (P-0621/P-0622) will be used to transfer tank 241-AY-102 supernatant to tank 241-C-106. When the supernatant is mixed, the slurry pump system	Procedure **TO-320-006,** *"TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS"* is used to transfer supernatant for this temperature	The use of the term "semi-automatic" when referring to nozzle operation is misleading. The nozzle tilt angles are manually set to the required inclinations while the pan angle

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	(P-1361/P1362) will transfer an equivalent amount of tank 241-C-106 supernatant back to tank 241-AY-102. During this operation, the sluicer is operated in semi-automatic mode to sweep the supernatant liquid surface to induce mixing. Also, the submersible slurry pump is positioned to minimize solids entrainment.	equilization effort. Step 5.2.16 initiates the sluice pumping system. Likewise, section 5.2.45 acknowledges start of the slurry pumps. Sluicing sweep path direction is provided in section 5.2.12---chosen for induced mixing (supernatant)	sweep can either be placed in "automatic" mode or manual. The use of "semi-automatic" is misleading because it refers to the situation of fixed tilt and automatic sweep which in fact is the *most* automatic arrangement the system can be assigned.
3.2.4, 3-19	Just before sluicing begins, the supernatant level in tank 241-C-106 will be adjusted to 183 cm (72 in.) (FDH 1998a).	Procedure **TO-320-006**, "***TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS***", section 5.3 provides direction for level adjustment.	The specific 72in. level is not identified in the procedure body rather it is required as process data control input.
3.2.5, 3-19	Enough dilute noncomplexed supernatant in tank 241-AY-102 will be pumped to establish an initial liquid waste inventory of 1.67 million L (440,000 gal).	This level adjustment to approximately 4.3 m is accomplished using procedure **TO-230-022**, "***TRANSFER FROM TK-102-AY TO TK-102-AW***".	N/A
3.2.5, 3-19	.....into the tank (241-AY-102) without exceeding the maximum liquid level limit of 9.2 m (364 in.).	Procedure **TO-320-004**, "***OPERATE WRSS DATA ACQUISITION SYSTEM***" provides tank 241-AY-102 waste surface level data while procedure **ARP-T-331-00007**, "RESPOND TO WRSS DATA ACQUISITION SYSTEM COMPUTER ALARMS" provides response direction in the event the limit is exceeded.	N/A
3.2.5, 3-20	Tank 241-AW-102 is the planned receiver for this transfer (see procedure TO-230-022). To prepare for the transfer, a waste compatibility assessment will be completed and the transfer route established.	The waste compatibility assessment for tank 241-AY-102 waste with tank 241-AW-102 has been completed and acknowledged by TWRS Double Shell Tank Engineering via internal correspondence 74100-98-021	N/A
3.2.6, 3-20	Tank 241-AY-102 supernatant will be chemically adjusted by adding approximately 88,000 L (23,000 gal) of 50 weight percent sodium hydroxide (caustic) to adjust the hydroxide concentration to 0.57 molar. Adjustments to the amount of caustic will be made if the volume of supernatant in the tank after the first pumping stage differs by more than 26,500 L (7,000 gal)..... The caustic addition is to be accomplished by off-loading caustic solution from a tank truck through a transfer hose connected to riser 15-O on the tank	Caustic addition to tank 241-AY-102 will be accomplished using procedure **TO-200-010**, "***ADDITION OF SODIUM HYDROXIDE TO 241-AY-102 OR 702-A DE-ENTRAINERS USING A VENDOR TRUCK***".	N/A
3.2.6, 3-20	After the caustic is added, four of five 17-ft air lift circulators will be activated and operated for a minimum of three days to ensure the concentrated caustic is uniformly mixed throughout the tank 241-AY-102 supernatant	The air lift circulators will be operated using procedure **TO-200-030** "***OPERATE AY & AZ AIRLIFT CIRCULATORS***".	N/A

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	.....		
3.2.7, 3-20	A supernatant sample of tank 241-AY-102 will be taken to establish a composition baseline for WRSS process control and to verify the end point of the chemical adjustment operation was achieved.	Procedure **T0-320-005**, "***WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL***" directs this sampling to take place as required for baselining efforts while **procedure TO-080-403**, "***SUPERNATE OR SLUDGE SAMPLING OF WASTE STORAGE TANKS***" provides instruction specific to the sampling activity.	N/A
3.2.7, 3-20	If the target hydroxide ion concentration is achieved, the sample will establish the baseline chemical composition of the sluice material.	Procedure **T0-320-005**, "***WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL***" section 4.3.5.1 requires a verification that desired hydroxide ion concentration has been achieved prior to pursuing further sluicing efforts.	N/A
3.2.9, 3-21	The transfer line routing for tank 241-AY-102 supernatant must be operable within 10 days at any time during the WRSS operations.	Procedure **TO-270-035**, "*CONTINGENCY PROCEDURE FOR ROUTING TANK 241-AY-102 SUPERNATE TO TANK 241-AP-106*" provides the instruction for supernate removal if needed to prevent or reduce the chances of a gas release event.	N/A
3.2.9, 3-21	.....is removal of the supernatant to reduce the chances of a gas release event occurring and/or minimizing the consequences of such an event.	Procedure **TO-270-035**, "***CONTINGENCY PROCEDURE FOR ROUTING TANK 241-AY-102 SUPERNATE TO TANK 241-AP-106***" provides the instruction for supernate removal if needed to prevent or reduce the chances of a gas release event.	N/A
3.2.9, 3-21	The decision to transfer supernatant and the volume to pump will be based on recommendations of the TRG after evaluating all available information.	No procedure is required for this decision.	N/A
3.2.9, 3-22	The transfer routing includes the SN-100 and SL-200 lines between tanks 241-C-106 and 241-AY-102 and the SL-503 transfer line in the 241-AY-02A pit. A jumper will be available for connecting the U11 nozzle (SL-100) to the U3 nozzle of the SL-503 transfer line. Tank 241-AP-106 is the selected receiver tank (see procedure TO-270-035). As a contingency, a waste compatibility assessment that assumes complete retrieval of tank 241-C-106 waste will be established for transferring the supernatant volume.	Procedure **TO-270-035**, "***CONTINGENCY PROCEDURE FOR ROUTING TANK 241-AY-102 SUPERNATE TO TANK 241-AP-106***" provides the instruction for supernate removal if needed to prevent or reduce the chances of a gas release event.	N/A

Section and Page Number of **HNF-SD-WM-PCP-013**	Requirement or Initiating Statement	Implementing Procedure or Document	Comments
3.3, 3-22	The retrieval of tank 241-C-106 sludge will be carried out in a series of small volume sluice batches followed by monitoring periods to ensure that control of thermal and flammable gas concerns is maintained.	Procedure **TO-320-005**, *"WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL"*, FIGURE 2 includes expected sluicing and monitoring periods for each campaign. These values are in conflict with the values in the Process Control Plan revision one.	Procedure TO-320-005 should be modified to reflect the expected monitoring and sluicing time increments as indicated in the Process Control Plan, revision 1.
3.3, 3-23 Figure 3-6, 3-24 Included in Appendix A	Figure 3-6 reflects the maximum length of each sluicing batch operation and the expected duration of the monitoring periods.	Procedure **TO-320-005**, *"WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL"*, FIGURE 2 includes expected sluicing and monitoring periods for each campaign. These values are in conflict with the values in the Process Control Plan revision one.	Procedure TO-320-005 should be modified to reflect the expected monitoring and sluicing time increments as indicated in the Process Control Plan, revision 1.
3.3, 3-23	During the initial stages of retrieving sludge from tank 241-C-106, the hydraulic head (waste surface level) must be controlled to keep sludge temperatures lower than the local saturation temperature, thereby preventing a possible steam release event.	Procedure **TF-OR-EF-C-D** *"C, CR TANK FARMS AND 244-A DCRT LIFT STATION DAILY ROUNDS"*, page 2 identifies the level limit range from 75" to 79" using the ENRAF Model 854 LIT. If adjustments to the level are required, procedure **TO-320-006**, *"TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS"* will be utilized.	N/A
3.3, 3-23	.....the mass of radiogenic high-heat solids transferred from tank 241-C-106 must be controlled to ensure the waste temperatures remain below the local saturation temperature.	Mass control is accomplished using the batch transfer strategy, applying maximum pump time limits, controlling slurry solids loading and routinely applying the mass balance procedure TO-320-003, "WRSS MASS BALANCE" as well as the HNF-SD-WM-PROC-021, *"TWRS PROCESS ENGINEERING INSTRUCTION MANUAL"*, section 23 (Material Balance) calculation.	N/A
3.3, 3-23	Gas generation and gas retention must be monitored during and after the retrieval of tank 241-C-106 waste to allow timely corrective measures if a gas release event appears probable.	SHMS data for 241-AY-12 is available from the DAS (procedure **TO-320-004**, *"OPERATE WRSS DATA ACQUISITION SYSTEM"*) and through rounds procedure **TF-OR-AYAZ-D**, *"AY AND AZ TANK FARMS DAILY ROUNDS"*. SHMS data for 241-C-106 is available through rounds procedure **TF-OR-EF-C-D**, *"C, CR TANK FARMS AND 244-A DCRT LIFT STATION DAILY ROUNDS"*. Tank 241-AY-102 exhaust rate is available as a DAS output. Tank 241-C-106 exhaust rate is available through rounds procedure **TF-OR-WRSS-C-1**," *C-FARM*	N/A

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		WRSS EQUIPMENT ROUNDS" and TMACS.	
3.3, 3-23	The magnitude of temperature increases will not become evident for months due to the large thermal time constant for tank 241-AY-102 (Ogden et al. 1998)). Therefore, the transient temperature response to the waste additions coupled with a thermal model for the tank, must be used to predict the peak temperatures in the tank.	Procedure **TO-320-005**, "*WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL*", section 4.3.12.5 requires thermal response evaluations of preceding transfers to be complete prior to initiating subsequent transfers.	N/A
3.3, 3-25	.....the first campaign also is characterized by the requirement to maintain a minimum hydraulic head on the tank 241-C-106 sludge.	Procedure **TF-OR-EF-C-D** "*C, CR TANK FARMS AND 244-A DCRT LIFT STATION DAILY ROUNDS*", page 2 identifies the level limit range from 75" to 79" using the ENRAF Model 854 LIT. If adjustments to the level are required, procedure **TO-320-006**, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*" will be utilized.	N/A
3.3, 3-25	During the operational phases of the WRSS process (i.e., sluicing batches and monitoring periods), a number of process variables are monitored on a continuous basis. These variables include the following: ☐ Tanks 241-C-106 and 241-AY-102 headspace gas concentration ☐ Tank 241-AY-102 waste level (ENRAF™ liquid level gauge) ☐ Tank 241-AY-102 temperatures (profile thermocouple trees, sludge thermocouple probes, air lift circulators thermocouples, MIT thermocouples, and under-tank thermocouples)	Gas Concentrations: SHMS data for 241-AY-12 is available from the DAS (procedure **TO-320-004**, "*OPERATE WRSS DATA ACQUISITION SYSTEM*") and through rounds **procedure TF-OR-AYAZ-D**, "*AY AND AZ TANK FARMS DAILY ROUNDS*". SHMS data for 241-C-106 is available through rounds procedure **TF-OR-EF-C-D**, "*C, CR TANK FARMS AND 244-A DCRT LIFT STATION DAILY ROUNDS*". Tank 241-AY-102 exhaust rate is available as a DAS output. Tank 241-C-106 exhaust rate is available through rounds procedure **TF-OR-WRSS-C-1**," *C-FARM WRSS EQUIPMENT ROUNDS*" and TMACS. Procedure **TO-320-004**, "*OPERATE WRSS DATA ACQUISITION SYSTEM*" and TMACS. **TO-320-004**, "*OPERATE WRSS DATA ACQUISITION SYSTEM*" TMACS	N/A

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Section and Page Number of HNF-SD-WM-PCP-013	Requirement or Initiating Statement	Implementing Procedure or Document	Comments
	☐ Tank 241-C-106 waste temperatures (thermocouple trees in risers R-8 and R-14) ☐ Tanks 241-C-106 and 241-AY-102 headspace pressures ☐ Tank 241-C-106 ventilation exhaust flow rate, and condenser inlet pressure, pressure drop, and outlet temperature ☐ Tank 241-C-106 chiller cooling solution flow rate, inlet and outlet temperatures ☐ Tank 241-AY-102 annulus ventilation flow rate and outlet temperatures ☐ Tank 241-AY-102 ventilation exhaust flow rate, outlet temperature, and relative humidity. ☐ Tank 241-AY-102 ventilation condenser cooling solution flow rate, inlet and outlet temperatures	For 241-C-106 procedure **TO-320-004, "*OPERATE WRSS DATA ACQUISITION SYSTEM*"** For 241-AY-102 procedure **TF-OR-EF-AYAZ-D, "*AY AND AZ TANK FARMS DAILY ROUNDS*"**. Procedures **TF-OR-EF-C-D and TF-OR-WRSS-C-1, "*C, CR TANK FARMS AND 244-A DCRT LIFT STATION DAILY ROUNDS*" &," *C-FARM WRSS EQUIPMENT ROUNDS*"** respectively. **TF-OR-WRSS-C-1," *C-FARM WRSS EQUIPMENT ROUNDS*"** Procedure **TO-320-004, "*OPERATE WRSS DATA ACQUISITION SYSTEM*"** Procedure **TO-320-004, "*OPERATE WRSS DATA ACQUISITION SYSTEM*"** Procedure **TO-320-004, "*OPERATE WRSS DATA ACQUISITION SYSTEM*"**	N/A
3.3, 3-26	In addition to the variables listed above, ***a number of additional process variables*** associated with the fluid handling equipment are monitored during the active sluicing operations. These variables include the following: ☐ Sluice pump system speed and flow rate ☐ Slurry pump system speed and flow rate	Procedure **TF-OR-EF-AYAZ-D, "*AY AND AZ TANK FARMS DAILY ROUNDS*"**. Procedure **TF-FT-WRSS-C, "*C-FARM WRSS OPERATIONS ROUNDS*"**	N/A

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	☐ Mass flowmeter slurry density, mass flow rate, and total solids mass transferred. ☐ Tank 241-AY-102 foaming (in-tank imaging system)	Procedure **TO-320-004**, *"OPERATE WRSS DATA ACQUISITION SYSTEM"* Procedure **TO-020-141**, *"IN TANK VIDEO PROCEDURE"*	N/A
3.3, 3-26	Other process variables are measured only during monitoring periods. They support the decision-making process on the amount of tank 241-C-106 sludge to be retrieved during the next sluice batch, if any, and on the best way to conduct the retrieval within the applicable technical constraints of the process. These variables include the following: ☐ Tank 241-AY-102 density profile (ENRAF™ densitometer) and solid-liquid interface ENRAF™ densitometer and MIT validation probe) (JKB 7/25/98) ☐ Tank 241-AY-102 supernatant and settled solids chemical and radionuclide composition, and physical properties obtained from grab samples ☐ Tank 241-AY-102 oil slick (in-tank imagining system) ☐ Tank 241-C-106 waste level (ENRAF™ liquid level gauge).	Density profiles will be established using procedure **T0-320-007**, *" OPERATE ENRAF MODEL 854 DENSITOMETER"* & **7-MISC-238**, *"AY-102 ENRAF DENSITOMETER SETUP AND MAINTENANCE"* Procedure **TO-080-403**, *"SUPERNATE OR SLUDGE SAMPLING OF WASTE STORAGE TANKS"* Procedure **TO-020-141**, *"IN TANK VIDEO PROCEDURE"* Procedure **TF-OR-EF-C-D** *"C, CR TANK FARMS AND 244-A DCRT LIFT STATION DAILY ROUNDS"*, page 2 identifies the level limit range from 75" to 79" using the ENRAF Model 854 LIT	This procedure provides instruction for general use. It will require a work package per step 4.3.3 to identify profile requirements (i.e. spatial direction etc.)
3.3, 3-26 Table 3-11, 3-27 Included in Appendix A	During each ***monitoring period***, specific process parameters are evaluated to determine the limitations placed on the next sluicing batch. The evaluations performed depend on whether the current sluicing batch completes an increment and/or a sluicing campaign. Table 3-11 lists the parameters that are evaluated and the monitoring period in which an	Procedures **TF-OR-EF-C-D** *"C, CR TANK FARMS AND 244-A DCRT LIFT STATION DAILY ROUNDS"*, **TF-OR-EF-AYAZ-D**, *"AY AND AZ TANK FARMS DAILY ROUNDS"*., Procedure **TO-320-004**, *"OPERATE WRSS DATA ACQUISITION SYSTEM"*	N/A

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	evaluation is performed.		
3.4.1, 3-27	The high cooling rate ventilation system operation for tank 241-C-106 uses the 296-P-16 exhauster, a high flow rate once-through system.	Procedure **TO-060-050**, " ***OPERATE 296-P-16 EXHAUSTER***" & Procedure **TO-320-001**, " ***OPERATE TK-241-C-106 HVAC CHILLER***"	N/A
3.4.1, 3-27	A chiller system operates in combination with the cooling coil to supply a constant 4.4 °C (40 °F) inlet air flow at the air intake.	Procedure **TO-060-050**, " ***OPERATE 296-P-16 EXHAUSTER***" identifies the acceptable startup range for the cooling coil discharge from 34 to 50 °F (TI-1362) .This temperature is monitored daily via procedure **TF-OR-EF-C-D**, " ***C, CR TANK FARMS AND 244-A DCRT LIFT STATION DAILY ROUNDS***"	N/A
3.4.2, 3-37	The fluid handling systems are shut down once the pre-determined amount of sludge has been transferred, or the maximum pump run time is reached.	Procedure **TO-320-006**, "***TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS***", section 5.5.7 bullets #3 and #4 provide direction to shut down fluid handling systems per remaining run time (based on solids transferred) or maximum run time criteria.	N/A
3.4.2.2, 3-37	During the retrieval phase of the WRSS process, ventilation systems support the waste handling and storage in tanks 241-AY-102 and 241-C-106.	The direction for ventilation system usage required for the WRSS process is identified in procedures **TO-060-050**, " ***OPERATE 296-P-16 EXHAUSTER***", **TO-060-121**, " ***OPERATE TK-241-AY-102 ANNULUS VENTILATION SYSTEM***", **TO-320-009**," ***OPERATE WRSS 296-C-006 HVAC SYSTEM***" and **TO-060-350**, "***START/STOP AND OPERATE AY/AZ TANK VENTILATION PRIMARY EXHAUST SYSTEM***". Additionally, in the case of an off-normal loss of ventilation event, portable exhausters are placed in use and operated per procedures **T0-060-047, TO-060-048**, and **TO-060-049** "***OPERATE EMERGENCY BACKUP 241-C-106 EXHAUSTER***", "***OPERATE EMERGENCY BACKUP 241-AY-102 EXHAUSTER***", "***OPERATE EMERGENCY BACKUP 241-AY-102 ANNULUS EXHAUSTER***" respectively.	N/A
3.4.2.2, 3.37	The 296-C-006 ventilation system is used during the active sluicing phase of the WRSS process.	Procedure **TO-320-009**, "***OPERATE WRSS 296-C-006 HVAC SYSTEM***"	Procedures TO-320-005 and TO-320-006 **do not verify the running condition of the 296-C-006 ventilation system as a pre-requisite for the initiation of transfer. Procedure/s modification is required.**
3.4.2.2, 3.37	Two ventilation systems are connected to and support tank	Operation direction for these two ventilation systems is provided for in procedures	N/A

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	241-AY-102 during sluicing operations. The new 241-AZ-702 system ventilates the primary tank and the 296-A-16 system ventilates the tank 241-AY-102 annulus.	**TO-060-121** & **TO-060-350** *"OPERATE TK-241-AY-102 ANNULUS VENTILATION SYSTEM"* & , *"START/STOP AND OPERATE AY/AZ TANK VENTILATION PRIMARY EXHAUST SYSTEM"* respectively.	N/A
3.4.2.2, 3.37	The 241-AZ-702 ventilation system will normally operate in the recirculation mode.	**TO-060-350** *"START/STOP AND OPERATE AY/AZ TANK VENTILATION PRIMARY EXHAUST SYSTEM"*	N/A
3.4.2.2, 3-38	The annulus space in tank 241-AY-102 is ventilated by a dedicated, independent ventilation system. During routine operations, the annulus ventilation system will be operated in high vacuum mode with the annulus wall inlet blocked with blank flanges to achieve a flow of 800 to 1,300 cfm to the annulus bottom cooling channels.	**TO-060-121** *"OPERATE TK-241-AY-102 ANNULUS VENTILATION SYSTEM"* & **TF-OR-EF-AYAZ-D** *" AY AND AZ TANK FARMS DAILY ROUNDS"*	**The acceptable annulus pressure ranges identified in these two procedures are in conflict.** For pressure indicator PI-102-AY the procedure *TO-060-121 specifies* a normal range of *(0.0 to –17) in W.G.* and procedure *TF-OR-EF-AYAZ-D* specifies an operating range of *(-0.1 to –12. 0) in W.G.* A procedure modification is required.
3.4.3, 3-38	Following the retrieval of sluicable solids from tank 241-C-106, the 296-C-006 ventilation will continue to operate indefinitely to confine radionuclides and hazardous chemicals in the tank waste……	The operating procedures developed for the Waste Retrieval Sluicing System do not include operational direction for post-campaign 3 tank 241-C-106 HVAC requirements.	N/A
3.5.1, 3-39	Low-end leak detection, high-end flushing capability, and cathodic protection are provided for both lines.	***Transfer line flushing*** is provided for by procedure **TO-320-014**, *"FLUSH WRSS TRANSFER LINES"*, ***Low-end leak detection*** is supported by: LDE-1366(Pump Pit 241-C-06A) LDE-1368(Sluice Pit 241-C-06C) LDE-1363(Pump Pit 241-C-106A SN-200 Encasement) LDE-1364(Sluice Pit 241-C-106C SN-100 Encasement) ***Cathodic Protection*** is in place and maintained per procedures: **6-TF-221**, *"INSPECTION OF CATHODIC PROTECTION RECTIFIERS"*, **6-TF-357**, *"CATHODIC PROTECTION SYSTEM TESTING"*, AND **6-TF-357ET**,*"CATHODIC PROTECTION SYSTEM TESTING EAST TANK FARMS"*	N/A
3.5.1, 3-39	Operational Limitations(Transfer Pipelines) Flow Rate - 2,460 L/min (650 gpm), 5.0 m/s (16.4	Procedure **TO-320-006**, *"TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM*	**The maximum specified volumetric flow rate as identified in procedures TO-320-**

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	ft/s) maximum (analyzed safety limit) 1,300 L/min (350 gpm), 2.7 m/s (8.8 ft/s) nominal operating 1,140 L/min (300 gpm), 2.3 m/s (7.6 ft/s) minimum (solids settling/line plugging)	*SLUICING OPERATIONS*", TABLE 2, "SWEEP PATH TILT ANGLES" identifies sluicing volumetric flow rates and associated nozzle pan and tilt settings to achieve a specified sluice path as described in FIGURE 1, "241-C-106 SLUICING MAP". Additionally, procedures, **TF-OR-WRSS-C** and **TF-OR-WRSS-AY**, "*C-FARM WRSS OPERATIONS ROUNDS*" & "*AY-FARM WRSS OPERATIONS ROUNDS*" respectively, identify volumetric flow ranges.	**006, TF-OR-WRSS-C , TF-OR-WRSS-AY is in conflict with that indicated in the process control plan.** The process control plan specifies a maximum volumetric flow rate of 650 gpm whereas the procedure TO-320-006 limit is stated as 500 gpm and rounds procedures at 450 gpm. Procedure changes are required including associated calculations that form the basis for TABLE 2, "SWEEP PATH TILT ANGLES"
	Pressure - 2.2 MPa (320 psig) maximum	Maximum pump shut off head is approximately 240 psig ref. FDNC Calc. W-320-27-048	Recommend modifying the DAS alarm temperature set points from 195° F to 180° F and pressure from 150 psig to 120 psig. These modifications will then envelope the operational temperature and pressure limits of the transfer pipelines, slurry pump sluicer and distributor as protected by DAS alarming.
	Temperature - 82 °C (180 °F) structural maximum, 49 °C (120 °F) operational limit	The operational limits imposed to protect non-pipe line equipment, the 180° F limit is protected by DAS alarms Ref. HNF-2115, pg B-1, TI-06231 to 06250	
	Solids Loading - 30 weight percent slurry line, 10 weight percent sluice line (The lower limit for the sluice line is required to minimize accident consequences of a tank 241-C-106 ventilation system failure - structurally the sluice line is capable of 30 weight percent.)	Slurry: Procedure **TO-320-006**, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*", **TO-320-004**, "*OPERATE WRSS DATA ACQUISITION SYSTEM*", and **ARP-T-331-00007**, "*RESPOND TO WRSS DATA ACQUISITION SYSTEM COMPUTER ALARMS*" Sluice: No formal procedure in place.	
3.5.1.2, 3-42	The winch assembly supports the submersible slurry pump and enables the raising and lowering of this pump to the desired level.	Procedure **TO-320-006**, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*"	N/A
3.5.1.2, 3-42	Operational Limitations (Slurry Pump) **Temperature**:		N/A

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	49 °C (120 °F) operational limit 82 °C (180 °F) structural limit **Discharge pressure:** 1.91 MPa (277 psig) maximum **Flow rate/line velocity of combine submersible and booster pumps:** 2,460 L/min (650 gpm), 5.0 m/s (16.4 ft/s) design maximum 1,300 L/min (350 gpm), 2.7 m/s (8.8 ft/s) nominal operating 1,140 L/min (300 gpm), 2.3 m/s (7.6 ft/s) safety minimum (Note: the 1,500 rpm minimum pump speed may preclude operation at this low flow rate.) **Minimum rotational speed:** 1,500 rpm (booster pump only to maintain upper bearing oiling) **Solids Loading:** 0 to 50 weight percent design, 30 weight percent safety limit	Maximum pump shut off head is approximately **240** psig ref. FDNC Calc. W-320-27-048 The operational limits imposed to protect non-pipe line equipment, the 180°F limit is protected by DAS alarms Ref. HNF-2115, pg B-1, TI-06231 to 06250 Procedure **TO-320-006**, *"TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS"*, TABLE 2, "SWEEP PATH TILT ANGLES" identifies sluicing volumetric flow rates and associated nozzle pan and tilt settings to achieve a specified sluice path as described in FIGURE 1, "241-C-106 SLUICING MAP". Additionally, procedures, **TF-OR-WRSS-C** and **TF-OR-WRSS-AY**, *"C-FARM WRSS OPERATIONS ROUNDS"* & *"AY-FARM WRSS OPERATIONS ROUNDS"* respectively, identify volumetric flow ranges. Procedure **TO-320-006**, *"TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS"* includes several warning statements specific to this lower speed limit. Procedure **TO-320-004**, *"OPERATE WRSS DATA ACQUISITION SYSTEM"*	Recommend modifying the DAS alarm temperature set points from 195° F to 180° F and pressure from 150 psig to 120 psig. These modifications will then envelope the operational temperature and pressure limits of the transfer pipelines, slurry pump sluicer and distributor as protected by DAS alarming. **The maximum specified volumetric flow rate as identified in procedures TO-320-006, TF-OR-WRSS-C , TF-OR-WRSS-AY is in conflict with that indicated in the process control plan.** The process control plan specifies a maximum volumetric flow rate of 650 gpm whereas the procedure TO-320-006 limit is stated as 500 gpm and rounds procedures at 450 gpm. Procedure changes may be required including associated calculations that form the basis for TABLE 2, "SWEEP PATH TILT ANGLES"
3.5.1.4, 3-44	The sluicer controls, located in the MO-211 control room, have two modes: manual and semi-automatic.	Procedure **TO-320-006**, *"TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS"*	**Clarification:** The .sluicer controls, located in MO-211 control room, have two controls: ***pan and tilt—pan can be operated in automatic mode.***
3.5.1.4, 3-44	Operational Limitations(Sluicer) Flow Rate - 2,460 L/min (650	Procedure **TO-320-006**, *"TK-241-C-106*	**The maximum specified volumetric flow**

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	gpm), 81 m/s (270 ft/s) maximum (analyzed safety limit) 1,300 L/min (350 gpm), 44 m/s (140 ft/s) nominal operating 1,140 L/min (300 gpm), 39 m/s (120 ft/s) minimum (solids settling/line plugging) Pressure - -1.24 MPa (180 psig) maximum Temperature - 82 °C (180 °F) structural maximum, 49 °C (120 °F) operational limit Solids Loading - 10 weight percent	*WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*", TABLE 2, "SWEEP PATH TILT ANGLES" identifies sluicing volumetric flow rates and associated nozzle pan and tilt settings to achieve a specified sluice path as described in FIGURE 1, "241-C-106 SLUICING MAP". Additionally, procedures, **TF-OR-WRSS-C** and **TF-OR-WRSS-AY**, "*C-FARM WRSS OPERATIONS ROUNDS*" & "*AY-FARM WRSS OPERATIONS ROUNDS*" respectively, identify volumetric flow ranges. Maximum pump shut off head is approximately **240** psig ref. FDNC Calc. W-320-27-048 The operational limits imposed to protect non-pipe line equipment, the 180° F limit is protected by DAS alarms Ref. HNF-2115, pg B-1, TI-06231 to 06250	**rate as identified in procedures TO-320-006, TF-OR-WRSS-C , TF-OR-WRSS-AY is in conflict with that indicated in the process control plan.** The process control plan specifies a maximum volumetric flow rate of 650 gpm whereas the procedure TO-320-006 limit is stated as 500 gpm and rounds procedures at 450 gpm. Procedure changes are required including associated calculations that form the basis for TABLE 2, "SWEEP PATH TILT ANGLES" Recommend modifying the DAS alarm temperature set points from 195° F to 180° F and pressure from 150 psig to 120 psig. These modifications will then envelope the operational temperature and pressure limits of the transfer pipelines, slurry pump sluicer and distributor as protected by DAS alarming.
3.5.1.5, 3-44	Operational Limitations(Slurry Distributor) Flow Rate - 2,460 L/min (650 gpm), 5.5 m/s (18 ft/s) maximum (analyzed safety limit) 1,300 L/min (350 gpm), 3.0 m/s (9.8 ft/s) nominal operating 1,140 L/min (300 gpm), 2.6 m/s (8.4 ft/s) minimum (solids	Procedure **TO-320-006**, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*", TABLE 2, "SWEEP PATH TILT ANGLES" identifies sluicing volumetric flow rates and associated nozzle pan and tilt settings to achieve a specified sluice path as described in FIGURE 1, "241-C-106 SLUICING MAP". Additionally, procedures, **TF-OR-WRSS-C** and **TF-OR-WRSS-AY**, "*C-FARM WRSS OPERATIONS ROUNDS*" & "*AY-FARM WRSS OPERATIONS ROUNDS*" respectively, identify volumetric flow ranges.	**The maximum specified volumetric flow rate as identified in procedures TO-320-006, TF-OR-WRSS-C , TF-OR-WRSS-AY is in conflict with that indicated in the process control plan.** The process control plan specifies a maximum volumetric flow rate of 650 gpm whereas the procedure TO-320-006 limit is stated as 500 gpm and rounds procedures at 450 gpm. Procedure changes are required including associated calculations that form the basis for TABLE 2, "SWEEP PATH TILT ANGLES"

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	settling/line plugging) Temperature - 82 °C (180 °F) structural maximum, 49 °C (120 °F) operational limit Pressure - 1.91 MPa (277 psig) maximum Solids Loading - 30 weight percent	Maximum pump shut off head is approximately 240 psig ref. FDNC Calc. W-320-27-048 The operational limits imposed to protect non-pipe line equipment, the 180°F limit is protected by DAS alarms Ref. HNF-2115, pg B-1, TI-06231 to 06250 Procedure **TO-320-004**, "*OPERATE WRSS DATA ACQUISITION SYSTEM*" and **ARP-T-331-00007**, "*RESPO ND TO WRSS DATA ACQUISITION SYSTEM COMPUTER ALARMS*"	Recommend modifying the DAS alarm temperature set points from 195° F to 180° F and pressure from 150 psig to 120 psig. These modifications will then envelope the operational temperature and pressure limits of the transfer pipelines, slurry pump sluicer and distributor as protected by DAS alarming.
3.5.2, 3-46	In addition, contingency provisions have been made to provide a portable exhaust system to back up each of these ventilation functions. Section 3.5.2.3 describes the portable exhaust system.	In the event of an off-normal loss of ventilation event, portable exhausters are placed in use and operated per procedures **TO-060-047, TO-060-048,** and **TO-060-049** "*OPERATE EMERGENCY BACKUP 241-C-106 EXHAUSTER*", "*OPERATE EMERGENCY BACKUP 241-AY-102 EXHAUSTER*", "*OPERATE EMERGENCY BACKUP 241-AY-102 ANNULUS EXHAUSTER*" respectively.	N/A
3.5.2.1, 3-46	**296-C-006 Ventilation System**: Operational Limitations. Temperature - 93 °C (200 °F) (HEPA filter limitation) Pressure - -0.3 to -4.0 in. w.g. Flow Rate - Tank: 1,040 to 1,220 cfm; Stack: 180 to 360 cfm	Procedures **TO-320-009** and **TF-OR-WRSS-C-1**, "*OPERATE WRSS 296-C-006 HVAC SYSTEM*" and "*C-FARM WRSS EQUIPMENT ROUNDS*", respectively include the following limitations: TIT-13365 HEPA Filter Outlet Temperature Limit = 200°F PI-13611 Inlet Pressure Range -1.0 to –4.0 in w.g. FI-13627A Exh. Stack Flow Rate: Normal Range: 100 to 350 cfm (TO-320-009)	The normal ranges of operation for the stack exhausting flow differ in the two

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	Solids Loading - 15 mg/m^3	220 to 320 scfm(TF-OR-WRSS-C-1) Limit: 360 cfm(TO-320-009) 360 scfm(TF-OR-WRSS-C-1) Excessive solids loading will be evidenced by substantially increased filter differential pressure indications. Filter differential pressure limits are established in both TO-320-009 & TF-OR-WRSS-C-1	procedures, as do the respective flow units. **An engineering review is required to clarify the ranges and associated units.**
3.5.2.1, 3-47	**296-P-16 Ventilation System:** Operational Limitations. Temperature 93 °C (200 °F) (HEPA filter limitation) Pressure -0.1 to -3.0 in. w.g. Flow Rate 2,400 to 4,200 cfm	Procedures **TO-060-050** and **TF-OR-EF-C-D**, *"OPERATE 296-P-16 EXHAUSTER"* and *"C, CR TANK FARMS AND 244-A DCRT LIFT STATION DAILY ROUNDS"*, respectively include the following limitations: TI-1-EXH-2 Outlet Temperature Limit = 200°F TK-241-C-106 Vacuum at FIC Riser -0.1 to –3.0 in w.g. Flow Rates Normal Range: **TBD** _____ **scfm** Limit: **TBD** _____ **scfm**	N/A
3.5.2.2, 3-47	Primary ventilation is provided by the 241-AZ-702 system the annulus ventilation system is the 296-A-19.	The procedures required to operate these two ventilation systems are **TO-060-121** and **TO-060-350**, *"OPERATE TK-241-AY-102 ANNULUS VENTILATION SYSTEM" &*, *"START/STOP AND OPERATE AY/AZ TANK VENTILATION PRIMARY EXHAUST SYSTEM"* respectively.	N/A
3.5.2.2, 3-50	Primary Tank Ventilation (241-AZ-702) Operational Limitations. Temperature - 91 °C (195 °F) (HEPA filter limitation) Pressure - 0 to -4 in. w.g.	**TBD** _____ °F **TBD** _____ **in. w.g.**	N/A

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	Flow rate - See HNF-SD-RE-TI-273 (depends on configuration)	**TBD_____scfm**	N/A
3.5.2.2, 3-50	Annulus Ventilation System (296-A-16) Operational Limitations. Temperature - 93 °C (200 °F) maximum Pressure - -0.1 to -18.0 in. w.g. Flow rate - 1,000 to 1,300 cfm to annulus bottom cooling channels when annulus wall inlet blocked with blank flanges.	The implementing procedures which include operational limits for the annulus ventilation system are **TO-060-121, TF-OR-EF-AYAZ-D** and **TF-OR-WRSS-C**"***OPERATE TK-241-AY-102 ANNULUS VENTILATION SYSTEM***" ,"***AY AND AZ TANK FARMS DAILY ROUNDS***" and "***C-FARM WRSS OPERATIONS ROUNDS***" respectively. Annulus Exhaust Air Temperature(TI-0620): 200°F (TF-OR-WRSS-C) Annulus pressure limit (PI-102-AY): 0.0 to -17 in. wg (TF-OR-EF-AYAZ-D) -0.1 to -12 in. wg (TO-060-121) Annulus Flow Rate(FI-0622) 1000 to 1200 scfm (TF-OR-WRSS-C)	The high vacuum limit identified within these two procedures are in conflict. A procedural change is required.
3.5.2.3, 3-53	If the tank 241-AY-102 or tank 241-C-106 ventilation systems become inoperable for any reason, portable exhausters will be available to restore ventilation to either the dome spaces (riser R-7 in tank 241-C-106 and riser 15K in tank 241-AY-102) or annulus (riser 19B in tank 241-AY-102)	In the event of an off-normal loss of ventilation event, portable exhausters are placed in use and operated per procedures **T0-060-047, TO-060-048,** and **TO-060-049** "***OPERATE EMERGENCY BACKUP 241-C-106 EXHAUSTER***", "***OPERATE EMERGENCY BACKUP 241-AY-102 EXHAUSTER***", "***OPERATE EMERGENCY BACKUP 241-AY-102 ANNULUS EXHAUSTER***" respectively. In addition to the procedures identified for portable exhauster operation, document HNF-3029, Revision 0, " DEPLOYMENT OF EMERGENCY BACKUP PORTABLE EXHASUTERS POR-007-Skid & POR-008-Skid F" identifies all necessary activities required to deploy in a timely manner.	N/A
3.5.3.1, 3-53	The mass flowmeter and pump performance parameters are	The mass flow rate is available to the user via the Data Acquisition System (DAS). The	Using pump parameters to determine mass flow rate is not an effort included in the

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	two ways of acquiring "real-time" process information. The mass flowmeter measures online the mass and density of slurry being transferred, thereby enabling the control of the total amount of solids and slurry solids loading. The pump performance parameters indicate the solids content in the slurry…… A combination of the pump speed setting and flow rate data will then be used to approximate the average solids loading of the slurry in the transfer line. This is used as a backup to the 241-AY-02A pit mass flowmeter data.	procedure required to operate the DAS is **TO-320-004, "*OPERATE WRSS DATA ACQUISITION SYSTEM*"**. Additionally, procedure **TF-OR-WRSS-C, "*C-FARM WRSS OPERATIONS ROUNDS*"** includes the logging (each 2hrs) of DAS available parameters such as slurry flow rate, slurry density, solids loading, 241-AY-102 liquid level, hydrogen concentration, annulus exhaust temperature and annulus exhaust air flow rate.	operational procedures. This comparative means to calculate mass flow parameters would be pursued by process engineering staff.
3.5.3.1, 3-54	An ENRAF™-Nonius Series 854 level gauge (WST-LIT-602A) is used to monitor the liquid level in tank 241-AY-102……	This level is indicated as both a DAS output, Procedure **TO-320-004, "*OPERATE WRSS DATA ACQUISITION SYSTEM*"** and logged on daily rounds in **"TF-OR-EF-AYAZ-D," *AY AND AZ TANK FARMS DAILY ROUNDS*"**	N/A
3.5.3.2, 3-57	Tank 241-AY-102 measurements made during monitoring periods include the in-tank imaging system, ENRAF™ level, ENRAF™ densitometer, the MIT, in-tank thermocouples, dome pressure, SHMS, primary ventilation temperature, flow and humidity, chiller solution flows and temperatures, and annulus flow and exit temperature. Ventilation information, level, SHMS, and temperature can be read at anytime through the data acquisition system (DAS).	Procedure: **TF-OR-EF-AYAZ-D," *AY AND AZ TANK FARMS DAILY ROUNDS*"** **TO-320-007,** "OPERATE ENRAF MODEL 854 DENSITOMETER" **7-MISC-238, "*AY-102 ENRAF DENSITOMETER SETUP AND MAINTENANCE*** **TO-320-004, "*OPERATE WRSS DATA ACQUISITION SYSTEM*** **TF-OR-WRSS-AY-1, "*AY-FARM WRSS EQUIPMENT ROUNDS*"**	N/A
3.5.3.2, 3-57	The tank **241-C-106 measurements** made during monitoring periods include a closed circuit television system, in-tank thermocouples, dome pressures, SHMS, ENRAF™ level, chiller solution flows and temperatures, and ventilation flows, temperatures, and pressures.	Closed circuit television system: Procedure **TO-320-011, "*OPRTATE WRSS IN-TANK IMAGING SYSTEM*"** In-tank thermocouples: **TO-320-004, "*OPERATE WRSS DATA ACQUISITION SYSTEM*"** & TMACS Dome pressures: **TO-320-004, "*OPERATE WRSS DATA ACQUISITION SYSTEM*"** & TMACS SHMS: SHMS data for 241-C-106 is available through rounds procedure **TF-OR-EF-C-D, "*C, CR***	N/A

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		TANK FARMS AND 244-A DCRT LIFT STATION DAILY ROUNDS". ENRAF™ level: TMACS Chiller solution flows and temperatures: Ventilation flows, temperatures, and pressures: **TF-OR-EF-C-D,** *"C, CR TANK FARMS AND 244-A DCRT LIFT STATION DAILY ROUNDS"* **TO-320-004,** *"OPERATE WRSS DATA ACQUISITION SYSTEM"*	N/A
3.5.3.2, 3-57	During the monitoring period following each sluicing batch, the evaluation of the sluicing system performance requires measuring the mass and volume of sludge transferred to tank 241-AY-102.	Data required to acknowledge both the mass and volume of transferred waste are available via user interface with the DAS. The operating procedure **TO-320-004,** *'OPERATE WRSS DATA ACQUISITION SYSTEM"* details its use. Furthermore, the document HNF-2318 *"Management of Data for Tank 241-C-106 Retrieval"* provides a means for remote end-user access when required.	N/A
3.5.3.2, 3-57	Setting the ENRAF™ displacer wire tension to as high a level as possible will minimize the excavating effect of interface measurements.	The operational procedure **TO-320-007,** *"OPERATE ENRAF MODEL 854 DENSITOMETER"* and accompanying maintenance procedure **7-MISC-238,** *" AY-102 ENRAF DENSITOMETER SETUP AND MAINTENANCE"* provide direction for the use of this device.	N/A
3.5.3.2, 3-58	Thermocouples (TE-102-1 through 102-27, TE-102-29 through 102-74, and TE-102-82 through 102-105) in tank 241-AY-102 are located at numerous positions inside the tank for measuring waste and dome space temperatures and at locations in the insulating concrete and concrete structural shell	**TO-320-004,** *'OPERATE WRSS DATA ACQUISITION SYSTEM"* **TO-040-660,** *"OBTAIN RECORD DOUBLE SHELL TANK TEMPERATURE DATA"*	N/A
3.5.3.2, 3-59	Tank 241-C-106 Thermocouple Trees. Tank 241-C-106 has two thermocouple trees to monitor the waste temperature: one in riser R-8 with six thermocouples, and one in riser R-14 with 12 thermocouples	End user temperature data needs from riser R-8 and riser R-14 are available on the TMCS. Processed data needs are managed through the strategy described in HNF-2318 "Management of Data for Tank 241-C-106 Retrieval"	N/A
3.5.3.2, 3-59	Tank 241-C-106 Submersible Slurry Pump Liquid-Level	**TO-320-006,** *"TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM*	

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	Detection When selected, the interlock shuts down the slurry submersible pump when the low-liquid level sensor changes state.	*SLUICING OPERATIONS*" **ARP-T-331-00005. "***RESPOND TO ALARMS AT ELECTRICAL EQUIPMENT SKID 241-AY-51***"**	N/A
3.5.3.2, 3-63	Standard Hydrogen Monitoring System. The SHMS system enables the continuous measurement of the hydrogen concentration in a tank's headspace. If concentrations of flammable gas greater than 25 percent of the lower flammability limit are detected, work or sluicing operations are suspended until the flammable gas is removed from the system.	Alarm response procedures provide direction on necessary actions required in the event that high hydrogen concentrations are detected. Alarm Responses to high hydrogen concentration detection are provided in procedures **ARP-T-331-00003(section 2-3), ARP-T-331-00005(section 3-1), ARP-T-331-00007 (pg 6 of 18)**entitled "***RESPOND TO ALARMS AT MO-211 WRSS CONTROL STATION***", "***RESPOND TO ALARMS AT ELECTRICAL EQUIPMENT SKID 241-AY-51" AND "RESPOND TO WRSS DATA ACQUISITION SYSTEM COMPUTER ALARMS***" respectively. In each procedure the required immediate response to the detection of high hydrogen gas concentrations is "**IF WRSS sluicing is in progress, SHUT DOWN WRSS pumping**". Operations are suspended until such time that it is safe to resume.	N/A
3.5.3.2, 3-63	Tank 241-AY-102 AnnulusVentilation Instrumentation. Tank 241-AY-102 data will be monitored during sluicing and monitoring periods so technical information used to model the expected thermal behavior of the tank can be updated and the waste transferred from tank 241-C-106 can be maximized.	**TO-320-004, '***OPERATE WRSS DATA ACQUISITION SYSTEM***"** **TF-OR-EF-AYAZ-D,"** ***AY AND AZ TANK FARMS DAILY ROUNDS*****"** **TF-OR-EF-AYAZ-W,"** ***AY AND AZ TANK FARMS WEEKLY ROUNDS*****"** **TMACS** ***Data Management Plan Document HNF-2318, Revision 0,***	N/A
3.5.3.2, 3-63	The energy balance calculation requires data for the air flow and temperature at the annulus exhaust.	This information is monitored and available from the DAS. Additionally, this information is logged every 2 hours during sluicing using operator rounds sheets. The two applicable procedures relative to this data need are **TO-320-004,"** ***OPERATE WRSS DATA ACQUISITION SYSTEM"*** **and TF-OR-WRSS-C,** "***C-FARM WRSS OPERATIONS ROUNDS***".	N/A
3.5.3.2, 3-65	Tank 241-AY-102 Primary Ventilation Instrumentation The primary system flow, temperature, relative humidity,	**TO-320-004, '***OPERATE WRSS DATA ACQUISITION SYSTEM***"** **TF-OR-EF-AYAZ-D,"** ***AY AND AZ TANK***	N/A

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	and condenser heat removal data (i.e., glycol temperature in and out and flow rate) are needed for this energy balance. In addition, the evaporation rate is an important input to the flammable gas evaluation.	*FARMS DAILY ROUNDS*" **TF-OR-EF-AYAZ-W,**" *AY AND AZ TANK FARMS WEEKLY ROUNDS*" **TMACS** *Data Management Plan Document HNF-2318, Revision 0,*	
3.5.3.2, 3-65	A relative humidity meter (AE/AIT/AI-0623) is installed to provide psychrometric information on tank 241-AY-102 exhaust.	The relative humidity information for 241-AY-102 ventilation exhaust is available as a DAS output. The required procedure is are **TO-320-004,**" *OPERATE WRSS DATA ACQUISITION SYSTEM*"	N/A
3.5.3.2, 3-65	A MASS-tron Mass Flow transmitter is installed on the tank 241-AY-102 ventilation system exhaust duct to measure the exhaust gas flow rate. This flowmeter is a microprocessor-based differential pressure transmitter with optional temperature and/or static pressure density compensation. A direct temperature reading can be obtained from the MASS-tron Mass Flow transmitter. A second means of measuring the exhaust air temperature is by a resistance temperature detector (RID) (TI-AY2K48-1B) located between the ventilation cooling system condenser and moisture separator upstream of the flowmeter. This temperature will be recorded by the project data acquisition system.	'The 241-AY-102 exhaust air temperature (TI-0620) is available as a DAS output. Additionally, this temperature is logged each 2 hours during sluicing operations on rounds sheets. The necessary procedures for acquiring this temperature information are **TO-320-004,**" *OPERATE WRSS DATA ACQUISITION SYSTEM*" and **TF-FT-WRSS-C** "*C-FARM WRSS OPERATIONS ROUNDS*".	N/A
3.5.3.2, 3-65	An in-tank imaging system is provided for tank 241-C-106 by project W-320. It provides real-time viewing of the tank's interior during sluicing operations and/or monitoring periods, whenever headspace visibility conditions permit.	Procedure **TO-320-011,** "*OPERATE WRSS IN-TANK IMAGING SYSTEM*", provides specific instruction on the operation of this device. Additionally, both procedures **T0-320-005,** "*WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL*" and **TO-320-006,** "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*" specify the requirement to use this camera.	N/A
3.5.3.2, 3-65	The imaging system shares the riser assignment with the portable exhauster, which is a backup for ventilating the tank in the event the main ventilation system fails. Removal of the imaging system would be required to activate the portable exhauster.	The removal of the camera in the event of a off-normal loss of ventilation circumstance is identified in HNF-3029, Revision 0, " DEPLOYMENT OF EMERGENCY BACKUP PORTABLE EXHASUTERS POR-007-Skid & POR-008-Skid F"	N/A
3.5.3.2, 3-65	A temporary mobile color camera system will be installed	Procedure **TO-020-141,** "*In-Tank Video Procedure*"	

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	for surveillance in tank 241-AY-102 during transfers from tank 241-C-106. It will be installed in riser 15A and used during active sluicing operations to monitor foaming inside the tank.		N/A
3.5.3.2, 3-66	The primary means for detecting a leak from tank 241-C-106 during sluicing operations is liquid level monitoring using the ENRAF™ level gauge..... ..... Sluicing operations would be shut down in a controlled manner for evidence of a tank leak.	Procedure **TO-320-006**, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*" provides instruction to shut down sluicing operations in the event of a leak detection (sections 5.2.3, 5.3.3, 5.4.3)	N/A
3.5.3.2, 3-66	Conductivity probes installed in the annulus and a continuous air monitor on the annulus ventilation exhaust train provide the leak detection capability for the tank.	Procedure **TO-320-006**, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*" provides instruction to shut down sluicing operations in the event of a leak detection (sections 5.2.3, 5.3.3, 5.4.3)	N/A
3.5.3.2, 3-66	The alarms for the sluice pipeline leak detector (LDE-1364) at sluice pit 241-C-06C and the slurry pipeline leak detector (LDE-1363) at pump pit 241-C-06A are located in the MO-211 operator station.	Alarm Response **procedure ARP-T-331-00003**, "*RESPOND TO ALARMS AT MO-211 CONTROL STATION*", sections 5-2 and 5-3 provide instruction in the event of detected slurry or sluice line leak.	N/A
3.5.3.2, 3-66	Each process pit has a leak detector with an alarm function in addition to the high-capacity pit drains. If these leak detectors alarm, the sluicing operation will enter a controlled shutdown. The alarms for the tank 241-C-106 sluice pit 241-C-06C leak detector (LDE-1368) and the pump pit 241-C-06A leak detector (LDE-1366) are located in the MO-211 operator station. The alarms for the tank 241-AY-102 sluice pit 241-AY-02E leak detector (LDE-102-32) and the pump pit 241-AY-02A leak detector (LDE-102-22A) are located in the Electrical Equipment Skid, 241-AY-51.	Alarm Response procedure **ARP-T-331-00003**, "*RESPOND TO ALARMS AT MO-211 CONTROL STATION*", sections 4-1 and 4-2 provide alarm response instruction in the event of 241-C-106 pump pit 06A and sluice pit 06C leakage. Alarm Response **procedure ARP-T-331-00005**, "*RESPOND TO ALARMS AT ELECTRICAL EQUIPMENT SKID 241-AY-51*, sections 5-3 and 6-3 provide instruction to respond to leaks detected at tank 241-AY-102 sluice pit 241-AY-02E and pump pit 241-AY-02A.	N/A
3.5.3.2, 3-67	The WRSS incorporates accelerometers (seismic switches) that will stop running transfer pumps if a significant seismic event is detected. This will minimize the volume of process wastes that could be released inadvertently to the environment if there is a breach in containment integrity.	Alarm Response **procedure ARP-T-331-00003**, "*RESPOND TO ALARMS AT MO-211 CONTROL STATION*", sections 1-4 provides alarm response instruction in the event of a seismic trip.	N/A
3.5.4, 3-72	The MO-211 control room operator will have remote control over the following equipment:		N/A

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	☐ aiming of the sluicer in pit 241-C-06C ☐ submersible slurry pump and its height adjusting winch in pit 241-C-06A ☐ in-tank imaging system at tank 241-C-106 ☐ tank 241-C-106 296-C-006 ventilation system operation ☐ booster pump speed control and on/off.	Instruction for the operator remote control of all listed equipment is identified in procedures **T0-320-005, "*WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL*"**, **TO-320-006, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*"** and **TO-320-011, "*OPERATE WRSS IN-TANK IMAGING SYSTEM*"**	N/A
3.5.5, 3-73	Raw Water. To meet equipment flushing and process water needs at C Farm, a raw water line was installed to the air and water service building, 241-C-73 from the 30.5 cm (12 in.) fire water line northwest of 241-C Tank Farm. Water requirements at tank AY-102 are to be met using a tank truck or over-ground hoses from existing raw water sources.	The direction for raw water usage and transfer line flushing is identified in procedures **TO-320-014, "*FLUSH WRSS TRANSFER LINES*"** and **TO-320-010, "*OPERATE WRSS RAW WATER SYSTEM*"**	N/A
4.0, 4-1	During active sluicing, operators will have direct control over the following process variables: the liquid level in tank 241-AY-102, sluice booster pump and slurry booster pump speeds, solids loading of the slurry being transferred in the slurry pipeline (sluice nozzle and submersible slurry pump positioning), and the mass of tank 241-C-106 waste transferred to tank 241-AY-102 (slurry pump system run time and mass flowmeter totalizer).	The control of each of the process variable described is identified in procedure **TO-320-006, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*"**	N/A
4.1, 4-5	The parameters of particular interest include slurry concentration, tank 241-C-106 waste temperatures, solids mass transfer into tank 241-AY-102, sluice nozzle movement, leak prevention/minimization, and transfer system flushing.	The parameters identified are either available or controlled through procedures: **T0-320-005, "*WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL*"**, **TO-320-006, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*"** **TO-320-014, "*FLUSH WRSS TRANSFER LINES*"** **TO-320-004," *OPERATE WRSS DATA ACQUISITION SYSTEM*"**	N/A
4.1.1, 4-5	The operator will control the solids content in the slurry transfer pipeline by directing the sluicer nozzle, adjusting the level of the submersible slurry pump suction (when permitted by thermal-hydraulic constraints), and setting	The control means in which solids loading is controlled is identified in procedure **TO-320-006, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*"**	N/A

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	transfer system flows with variable speed pumps based on measured slurry properties.		
4.1.1, 4-6	The slurry solids mass loading can be determined from the output of the mass flowmeter. This parameter is displayed in the MO-211 control room and can be monitored to control solids loading during a sluicing batch.	The output of the mass flow meter can be attained as a DAS output. The procedure necessary for operating the DAS is **TO-320-004,"** ***OPERATE WRSS DATA ACQUISITION SYSTEM"***	N/A N/A
4.1.1, 4-6	The pump curve correlates the pump speed, discharge pressure, and flow rate. The pump speed and flow rate parameters are displayed in the MO-211 control room.	Pump speed, discharge pressure and flow rate are attained as DAS outputs. The procedure necessary for operating the DAS is **TO-320-004,"** ***OPERATE WRSS DATA ACQUISITION SYSTEM"***	N/A
4.1.1, 4-6	The minimum pump speed of 1,500 rpm is required to maintain the level of lubrication specified by the pump manufacturer.	Caution statements are included in procedure **TO-320-006,** ***"TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS"*** (section 5.3.13-example) to prevent the pumps from running at speeds of less than 1500 RPM.	N/A
4.1.1, 4-9	To start sluice batch 1.1.1 (see Figure 3-5), the P-1361 submersible slurry pump is positioned so that its low-level detector is located at 178 cm (70 in.). The P-0621/P-0622 sluice pump system is then started and the flow rate is adjusted to a nominal 1,325 L/min (350 gal/min). Once the sluicer flow is verified in tank 241-C-106, the sluice stream is aimed towards the region of the P-1361 submersible slurry pump intake. The P-1361/P-1362 slurry pump system is started next, and the P-1362 slurry booster pump speed is set at a nominal 1,624 rpm.	Direction to initiate sluicing batch 1.1.1 is provided in section 5.4.1 of procedure **TO-320-006,** ***"TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS"***. Pump speeds are established in the range 1614 to 1634 RPM in section 5.4.51.	N/A
4.1.1, 4-9	The P-1361/P-1362 slurry pump system is started next, and the P-1362 slurry booster pump speed is set at a nominal 1,624 rpm.	Procedure **TO-320-006,** ***"TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS"*** section 5.10.4.2 directs the adjustment of pumps 1361/1362 to between 1614 and 1634 RPM when acceptable solids loading condition is established.	N/A
4.1.1, 4-9	The operator adjusts the position of the sluicer nozzle, which is normally set in the semi-automatic operating mode, to gradually increase sluicing efficiency to produce a slurry stream containing 0 weight percent to 10 weight percent	Procedure **TO-320-006,** ***"TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS"*** directs the operator(Section 5.10.4.2) to pursue a solids loading value per the batch control record,	The procedure **TO-320-006,** ***"TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS"*** and the process control plan are in conflict relative to the desired solids loading level.

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	solids loading.	WRSS operations engineer, and WRSS project engineer.	A procedure change is required.
4.1.1, 4-9,10	During routine sluicing, the operator continues adjusting the sluicer nozzle position to maintain a stable solids loading of 0 weight percent to 10 weight percent		
4.1.1, 4-10	.....a 20 weight percent solids loading indicated by the mass flowmeter will cause an alarm to sound. Additionally, the flow rate from the mag-flow meter for a 20 weight percent solids loading will cause a redundant alarm to sound.	**TO-320-006, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*"** **TO-320-004," *OPERATE WRSS DATA ACQUISITION SYSTEM*"** **ARP-T-331-00007, "*RESPOND TO WRSS DATA ACQUISITION SYSTEM COMPUTER ALARMS*"**	N/A
4.1.1, 4-10	For a different pump speed setting, the mag-flow meter alarm function will be set for the corresponding flow rate determined by Figures 4-2 and 4-3. The response to either of these alarms will be to take action to avoid a further increase in solids loading and to reduce the solids loading to below 20 weight percent.	**TO-320-006, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*"** **TO-320-004," *OPERATE WRSS DATA ACQUISITION SYSTEM*"** **ARP-T-331-00007, "*RESPOND TO WRSS DATA ACQUISITION SYSTEM COMPUTER ALARMS*"**	N/A
4.1.1, 4-10	The process control actions below will reduce the solids loading to below 20 weight percent: 1. Raise the submersible slurry pump level. 2. Direct the sluice stream to the area of the submersible slurry pump intake to dilute the solids entering the pump. 3. Increase the pump speed to achieve a 1,700 L/min (450 gal/min) flow rate until the higher solids content slurry clears the transfer system. After completing this action, the slurry loading process control pump speed setting (i.e., nominally 1,624 rpm) will be reestablished to continue the sluice batch.	**TO-320-006, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*"** **ARP-T-331-00007, "*RESPOND TO WRSS DATA ACQUISITION SYSTEM COMPUTER ALARMS*"**	N/A
4.1.1, 4-10	Before the end of a sluicing batch, the submersible slurry pump height and/or sluicer aiming are adjusted to reduce the	**TO-320-006, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM***	N/A

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	solids loading in the slurry pipeline.	*SLUICING OPERATIONS*"	
4.1.1, 4-10	A minimum of 15 minutes before the scheduled shutdown of a sluicing batch, the operator raises the submersible slurry pump level and directs the sluice stream to the area of the submersible slurry pump intake to dilute the solids entering the pump. At the nominal 1,624 rpm slurry booster pump speed setting, approximately 1,325 L/min (350 gal/min) of relatively solids-free solution is used to flush out the slurry transfer pipeline. After at least one-and-a-half pipeline volumes (i.e., 6,400 L [1,690 gal]) of relatively solids-free solution have been transferred, the sluice pump system and slurry pump system are shut down.	**TO-320-006**, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*"	The maximum allowed pump run time identified in the **TO-320-006** procedure is 11.5 hours. This value is less than 12 hours to account for time to shut down the system.
4.1.2, 4-11	During the first sluicing campaign, the tank 241-C-106 liquid level will be controlled to maintain a hydrostatic head in the tank needed for sludge temperature control. For sluice batch 1.1.1, this liquid level limit is greater than 178 cm (70 in.) of waste in the tank.	**TO-320-006**, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*" **TF-OR-EF-C-D**, "*C, CR TANK FARMS AND 244-A DCRT LIFT STATION DAILY ROUNDS* **TMACS**	N/A
4.1.2, 4-11	To ensure the liquid head on the sludge in the tank is not lowered below the established limit during each sluice batch of the first campaign, the pump winch is locked out to fix the elevation of its lower liquid level sensor. At startup, the tank 241-AY-102 operator will try to maintain the tank 241-AY-102 liquid level constant by monitoring the ENRAF™ level gauge and adjusting the P-0622 sluice booster pump speeds. The operator will have to take into account the approximate 8,500 L (2,250 gal) hold up in the transfer pipeline system.	**TO-320-006**, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*" **TO-320-004**," *OPERATE WRSS DATA ACQUISITION SYSTEM*" **TMACS**	N/A
4.1.2, 4-12	The level in tank 241-C-106 is verified during sluicing by the absence of the submersible slurry pump level low-level alarm, which is interlocked to shutdown P-1361/P-1362 slurry pump system when activated.	**TO-320-006**, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*"	N/A
4.1.2, 4-12	The liquid level in tank 241-C-106 is controlled during all phases of the WRSS process to minimize the potential for a tank leak. At all times during the process, controls will be	**TO-320-006**, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*"	

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	implemented to maintain the liquid level below the maximum 2 m (79 in.) limit (LMHC 1997a).	**TF-OR-EF-C-D, "*C, CR TANK FARMS AND 244-A DCRT LIFT STATION DAILY ROUNDS*** **TO-320-004," *OPERATE WRSS DATA ACQUISITION SYSTEM*"** TMACS	N/A
4.1.2, 4-12	The ENRAF™ level gauge is operated during the monitoring periods to show compliance with the limit.	**TF-OR-EF-C-D, "*C, CR TANK FARMS AND 244-A DCRT LIFT STATION DAILY ROUNDS*** TMACS	N/A
4.1.3, 4-13	the sluice nozzle will not be directed to the remaining tank wall until the end of the sluicing operations. Because sluicing the wall could cause a leak by breaching a weak point in the tank wall, the sluice stream will not be directed closer than 1.5 m (5 ft) to the tank wall during most of the sluicing operation.	Procedure **TO-320-006, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*"**, warning statements are included in sections 5.5, 5.6, 5.7, 5,8, 5.9 indicating the requirement to not direct the sluicing jet past the five foot no-strike zone.	N/A
4.1.3, 4-13	The procedure for controlling slurry concentration will apply with the operator adjusting the sluicer tilt angle and sweep cycles to achieve the desired solids loading (i.e, an expected 0 to 10 weight percent solids concentration) in the slurry transfer pipeline. Because the goal is uniform retrieval, one constraint on the sluicer operation is to sweep the entire tank cross-section (except the no-sluice zone) during the pump run time.	**TO-320-006, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*"** **TO-320-004," *OPERATE WRSS DATA ACQUISITION SYSTEM*"**	N/A
4.1.3, 4-15	During all sluicing operations, the in-tank imaging system will be used to monitor the in-tank process to the extent possible, depending on fog removal capability of the ventilation system.	**TO-320-011, "*OPERATE WRSS IN-TANK IMAGING SYSTEM*"** **TO-320-006, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM***	N/A
4.1.4, 4-15	Following an increment, a tank thermal analysis is performed. Flammable gas evaluations are conducted after two sluice increments (a sluice campaign) have been retrieved.	**T0-320-005, "*WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL*"**	N/A
4.1.4, 4-15	However, at startup of sluicing operations, use of the mass flowmeter will not be relied upon for mass transfer control during the very first batch, even though it is expected to be fully operational to perform its intended function.	**TO-320-006, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM***	The reduced maximum run time of 12 hours to 4.5hours for the first batch is a consequence of sluicing as if the mass transfer interments are not funtioning properly. The actual maximum pump time will need to be approximately 4.0 hours so

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			as to account for the time required to shut down the system.
4.1.4, 4-15	Mass transfer control during the first sluice batch will be achieved by establishing a maximum slurry pump system run time of 4-1/2 hours.	TO-320-006, *"TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM"*	Specific direction relative to this 4.5 hour run time(batch 1.1.1) is not included in the procedure. However this information will be provided in the batch record that Process Engineering completes as a prerequisite to batch transfer.
4.1.4, 4-16	By integrating the product of the slurry solids loading and slurry mass flow rate overtime, the total mass of particulate solids transferred during sluicing can be calculated. This parameter is displayed for the current increment in the MO-211 control room and can be monitored to control sluicing to the mass transfer limit.	Total mass of solids transferred is a DAS output. The procedure required is TO-320-004," *OPERATE WRSS DATA ACQUISITION SYSTEM"*	N/A
4.1.4, 4-20	The MO-211 control room provides a direct readout of remaining pump run time during a sluice batch based on the above algorithm.	TO-320-004," *OPERATE WRSS DATA ACQUISITION SYSTEM"*	N/A
4.1.4, 4-20	After the pump run time limit is reached (12 hours or less), the slurry pump system must be shut down. As indicated in Section 4.1.1, the shutdown procedure begins a minimum of 15 minutes before the scheduled pump shutdown to allow time for performing a solution flush of the slurry pipeline.	TO-320-006, *"TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM"*	Maximum pump run time limit identified in the TO-320-006 procedure is 11.5 hours so as to account for shut time.
4.1.5, 4-20	Process supernatant flushing of the slurry pipeline is done routinely to prevent the buildup of solids in the slurry line. In addition, if a beginning solids buildup is identified during process monitoring, one of following two flushing operations would be undertaken to correct the problem.	TO-320-014, *"FLUSH WRSS TRANSFER LINES"*	N/A
4.1.5, 4-21	Both the sluice and slurry transfer lines can be water-flushed from the tank 241-AY-102 end using flush connections in the sluicing system jumpers, located in the 241-AY-02A (slurry distributor) pit and 241-AY-02E (sluice pump) pit. Cover block shielding plugs are first removed from the AY Farm pit cover blocks enabling access to the flushing port blank. The blank is removed and a flushing adapter jumper is attached in its place. Water from a tank truck is pumped through the transfer line to achieve the required flush.	TO-320-014, *"FLUSH WRSS TRANSFER LINES"*	N/A

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	A minimum of one-and-a-half pipeline volumes is required to flush each transfer pipeline. This volume equates to 6,400 L (1,690 gal) for each of the SN100 and SN200 transfer pipelines for a total of 12,800 L (3,380 gal).		
4.2, 4-21	The primary mass transfer verification method uses the ENRAF™ densitometer installed on riser 15-E of tank 241-AY-102. Grab samples taken from riser 15-O supplement the ENRAF™ results. Additionally, the MIT will be monitored to provide supporting evidence of the liquid-solid interface.	**TO-320-004**," *OPERATE WRSS DATA ACQUISITION SYSTEM*" **TO-320-007**, "*OPERATE ENRAF MODEL 854 DENSITOMETER*" **7-MISC-238**, " *AY-102 ENRAF DENSITOMETER SETUP AND MAINTENANCE*" **TO-080-403**, "Supernate or Sludge Sampling of Waste Storage Tanks"	N/A
4.2, 4-22	The ENRAF™ densitometer in tank 241-AY-102 is used to obtain two key pieces of information: the density profile of the waste below the supernatant surface and the level of the supernatant-sludge interface.	**TO-320-007**, "*OPERATE ENRAF MODEL 854 DENSITOMETER*" **7-MISC-238**, " *AY-102 ENRAF DENSITOMETER SETUP AND MAINTENANCE*"	Procedure **TO-320-007** provides instruction for the general usage of the Model 854 densitometer. Specific direction such as spatial measurement requirements are coupled to the procedure action using a work package.
4.2, 4-22	Therefore, the best results are obtained if the densitometer measurement is made immediately after completing each batch when the highest possible fraction of solids is still suspended.	**T0-320-005**, "*WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL*"	Although the TO-320-005 provides the direction to utilize procedure TO-320-007 to gather required density measurements, it does not convey the need to deploy the device soon after the batch is terminated. The TO-320-005 requires clarification/modification to acknowledge this.
4.2, 4-22	Grab samples are obtained from the tank to refine the estimated amount of tank 241-C-106 sludge that has been transferred and to estimate the radiogenic heat associated with the sludge. Section 4.6 discusses the process control sampling requirements and schedule in more detail.	**TO-080-403**, "Supernate or Sludge Sampling of Waste Storage Tanks"	N/A
4.2, 4-22 Table 4-2, 4-23 Included in Appendix A	A density profile of tank 241-AY-102 is obtained with a lap-top computer that connects to the Communication Interface Unit (CIU) located in the 241-AY-801 building.	**TO-320-007**, "*OPERATE ENRAF MODEL 854 DENSITOMETER*" **7-MISC-238**, " *AY-102 ENRAF DENSITOMETER SETUP AND MAINTENANCE*"	N/A
4.2, 4-23	Using the portable computer, the operator enters commands to lower the displacer into the waste to obtain a density profile.	**TO-320-007**, "*OPERATE ENRAF MODEL 854 DENSITOMETER*" + task specific work package	N/A

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4.2, 4-23	In generating a density profile, density measurements are made in 30.5 cm (12 in.) increments referenced to an elevation of 193.87 m (636.07 ft) or 3.96 m (156 in.) above the tank bottom.	**TO-320-007**, "*OPERATE ENRAF MODEL 854 DENSITOMETER*" + task specific work package	N/A
4.2, 4-23	After the first sluicing batch of the campaign, density profile measurements will start at the 3.96 m (156 in.) waste level and descend in 30.5 cm (12 in.) increments until neutral buoyancy is achieved.	**TO-320-007**, "*OPERATE ENRAF MODEL 854 DENSITOMETER*" + task specific work package	N/A
4.2, 4-23,24	When the tank 241-AY-102 waste level begins to increase during subsequent batches, the starting elevation for the density profile measurements indexes in 30.5 cm (12 in.) increments. The number of ascending increments depends on the new supernatant surface elevation. However, no density measurement is to be made at less than 15.2 cm (6 in.) below the waste surface to ensure total submergence of the ENRAF™ displacer.	**TO-320-007**, "*OPERATE ENRAF MODEL 854 DENSITOMETER*" + task specific work package	N/A
4.2, 4-24	If waste stratification occurs, then waste homogenization operations can be performed in tank 241-C-106 to more uniformly distribute the heat load.	**TO-320-006**, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM*"	N/A
4.2, 4-24	Therefore, the primary measurement method for determining mass transfer for each sluicing batch will be the ENRAF™ densitometer. The mass flowmeter will provide backup measurement in case substantial solids settling occurs before ENRAF™ measurements can be made or in case of densitometer instrument problems.	**TO-320-007**, "*OPERATE ENRAF MODEL 854 DENSITOMETER*" **TO-320-004**," *OPERATE WRSS DATA ACQUISITION SYSTEM*" HNF-2318, Revision 0, "*MANAGEMENT OF DATA FOR TANK 241-C-106 RETRIEVAL*"	N/A
4.2, 4-25	Before the next sluicing batch is started, the value of M_{hold} is set equal to either the mass of particulate solids transferred during the current sluicing increment or zero (0) for the start of the new increment. The net particulate solids mass reading (M_{plc}) on the mass flowmeter net flow computer is also reset to zero (0) at the beginning of every batch.	**TO-320-006**, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM*" **TO-320-004**," *OPERATE WRSS DATA ACQUISITION SYSTEM*"	N/A
4.3.1, 4-26	All operable thermocouples on the thermocouple trees installed in risers 8 and 14 of tank 241-C-106 are monitored on a continuous basis to determine the waste temperature	R8 and R14 thermocouple data are available using the TMACS.	Procedure **TO-320-005** requires a modification to verify the minimum number of thermocouples required for analyses are

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	response during all phases of the retrieval process. The minimum number of operable tank 241-C-106 thermocouples required for the WRSS process is one bottom thermocouple on either the riser 8 or riser 14 thermocouple tree and one dome space thermocouple.		available as a verification statement .
4.3.1.1, 4-29	This baseline is initiated following the start of tank 241-C-106 waste subcooling operations and continues concurrent with the cooling operation until the start of sluicing.	Thermal model baselining and benchmarking efforts are included in the Project W-320 schedule. Initial ventilation/cooling data for the 296-P-16 exhauster / chiller combination became available in early July 1998.	N/A
4.3.1.1, 4-29	The newer restrictive limit of Administrative Control 5.26 requires waste temperatures to be at wintertime temperature, thermocouple 1 on riser 8 thermocouple tree ~64 °C (148 °F)	**T0-320-005**, "*WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL*"	N/A
4.3.1.2, 4-29 Table 4.4, 4-30 Included in Appendix A	Table 4-4 presents the in-tank thermocouples that will be monitored during all sluice batches of the WRSS process and the waste temperature limits that apply for the batches making up each of the planned sluice increments.	**TO-320-006**, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM*" **TF-OR-EF-C-D**, "*C, CR TANK FARMS AND 244-A DCRT LIFT STATION DAILY ROUNDS*	N/A
4.3.1.2, 4-31	A recovery plan is to be prepared, approved and implemented immediately to restore the waste temperatures to within limits.	**T0-320-005**, "*WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL*"	N/A
4.3.1.3, 4-31	The tank 241-C-106 in-tank thermocouples will continue to be monitored and recorded during monitoring periods following each sluice batch.	**TF-OR-EF-C-D**, "*C, CR TANK FARMS AND 244-A DCRT LIFT STATION DAILY ROUNDS* In-tank temperature data will be managed and to some extent processed via HNF-2318, Revision 0, "*MANAGEMENT OF DATA FOR TANK 241-C-106 RETRIEVAL*". **TMACS**	N/A
4.3.1.3, 4-31	Also, the tank 241-C-106 liquid level will be maintained to comply with applicable limits during the monitoring periods.	**TF-OR-EF-C-D**, "*C, CR TANK FARMS AND 244-A DCRT LIFT STATION DAILY ROUNDS* **TO-320-006**, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM*"	N/A
4.3.1.3, 4-32	Before the liquid level control limit is lowered for the next sluice batch, the monitoring period must be long enough to increase the subcooling margin so the pre-sluicing subcooling margin will be maintained when the supernatant is lowered to the desired level.	**T0-320-005**, "*WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL*"	N/A
4.3.1.3, 4-32	The amount of time needed to achieve the required degree of	Thermal analyses will be conducted based on	The thermal analyses will only provide an

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	subcooling will be determined by computer modeling.....	information gathered during the monitoring period. This information will be used to estimate the required chilling time prior to the next sluicing effort.	estimate of the required chilling time. Reaching temperatures at risers 8 and 14 less than 148°F will provide the indication of adequate sub-cooling.
4.3.2, 4-34	During sluicing operations, sludge temperatures (using the existing in-tank thermocouples and MIT) and insulating concrete temperatures will be monitored and the observed temperatures correlated with heat balance data provided by ventilation system airflow rates, temperatures, and humidities.	**TO-320-004**," *OPERATE WRSS DATA ACQUISITION SYSTEM*" In-tank temperature data will be managed and to some extent processed via HNF-2318, Revision 0, "*MANAGEMENT OF DATA FOR TANK 241-C-106 RETRIEVAL*".	N/A
4.3.2, 4-34	Ventilation of the tank 241-AY-102 primary tank and annulus during all sluicing operations will be provided by the 241-AZ-702 and 296-A-16 systems, respectively.	**T0-320-005**, "*WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL*" **TO-060-121**,"*OPERATE TK-241-AY-102 ANNULUS VENTILATION SYSTEM*" **TO-060-350**, *START/STOP AND OPERATE AY/AZ TANK VENTILATION PRIMARY EXHAUST SYSTEM*"	N/A
4.3.2, 4-34	The 296-A-16 annulus system will operate at high vacuum and with the annulus wall inlet blocked to maintain a flow of 800 to 1,300 cfm of air to the annulus bottom cooling channels.	**TO-060-121**,"*OPERATE TK-241-AY-102 ANNULUS VENTILATION SYSTEM*" **TO-320-004**," *OPERATE WRSS DATA ACQUISITION SYSTEM*" **TF-OR-WRSS-C**, "*C-FARM WRSS OPERATIONS ROUNDS*"	N/A
4.3.2, 4-34	The thermocouples and MIT in tank 241-AY-102 (see Table 3-9) will be continuously monitored throughout the sluicing operations to ensure that actual thermal behavior remains consistent with the estimated temperatures predicted by project thermal analysis (Ogden et al. 1998). The minimum number of operable thermocouples required for the WRSS process is one tank dome space thermocouple, one supernatant thermocouple, one sludge thermocouple, the MIT validation probe, and six insulating concrete thermocouples (TE-102-1, -3, -6, -10, -14, and -24). If at any time the sludge temperature profiles indicate a significant adverse departure from the estimates, sluicing operations will be suspended to allow for further analysis of the tank conditions and to restore waste temperatures within allowable limits.	**TO-320-004**," *OPERATE WRSS DATA ACQUISITION SYSTEM*" In-tank temperature data will be managed and to some extent processed via HNF-2318, Revision 0, "*MANAGEMENT OF DATA FOR TANK 241-C-106 RETRIEVAL*". **TMACS**	N/A

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4.3.2.2, 4-35	waste temperatures in tank 241-AY-102 will be continuously monitored to ensure compliance with temperature limits. Table 4-6 lists the in-tank thermocouples that will be monitored during sluice batches, which make up each of the planned sluice increments, and compared with the waste temperature limit.	**TO-320-004,"** ***OPERATE WRSS DATA ACQUISITION SYSTEM"*** **T0-320-005,** ***"WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL"***	N/A
4.3.2.3, 4-35	The tank 241-AY-102 in-tank thermocouples and MIT will continue to be monitored and recorded during monitoring periods following each sluice batch. The waste temperature control limit for the applicable thermocouples is the same as that of Table 4-6. The recovery actions of LCS/LCO 3.3.2 are to be entered into immediately if any of the waste temperatures exceed the 91 °C (195 °F) limit	**TO-320-004,"** ***OPERATE WRSS DATA ACQUISITION SYSTEM"*** **T0-320-005,** ***"WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL"***	N/A
4.3.2.3, 4-37	Measurement of the thermal response of the waste in tank 241-AY-102 will be made for a minimum of seven days following the completion of a sluice increment to collect the data required for computer analysis of steady-state temperatures…… Data requirements include the following: □ Tank thermocouples and MIT (see Table 3-9). □ Supernatant-solids interface (see Table 4-2 for ENRAF™ densitometer, MIT fixed elements, and MIT validation probe measurements). □ Tank 241-AY-102 primary ventilation system flow rate, temperature, and humidity. □ Tank 241-AY-102 AY102-K4-8-1 condenser glycol/water flowrate and inlet and outlet temperatures. □ Tank 241-AY-102 annulus ventilation system flow rate and temperature.	**TO-320-004,"** ***OPERATE WRSS DATA ACQUISITION SYSTEM"*** **TO-320-007,** ***"OPERATE ENRAF MODEL 854 DENSITOMETER"*** **TO-320-004,"** ***OPERATE WRSS DATA ACQUISITION SYSTEM"*** **TF-OR-EF-AYAZ-D,** ***"AY AND AZ TANK FARMS DAILY ROUNDS"*** **TO-320-004,"** ***OPERATE WRSS DATA ACQUISITION SYSTEM"*** **TF-OR-WRSS-C,** ***"C-FARM WRSS OPERATIONS ROUNDS"*** **TF-OR-EF-AYAZ-D,** ***"AY AND AZ TANK***	N/A

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		FARMS DAILY ROUNDS" **TO-320-004**," *OPERATE WRSS DATA ACQUISITION SYSTEM*"	
	□ Mass of tank 241-C-106 sludge transferred (see Sections 4.1.4 and 4.2)	**TO-320-004**," *OPERATE WRSS DATA ACQUISITION SYSTEM*"	
4.3.2.3, 4-38 Table 4-7, 4-38 Included in Appendix A	The prediction that tank 241-AY-102 steady-state temperatures comply with the Table 4-7 temperature limits is a requirement for proceeding with the next sluicing increment.	**T0-320-005**, "*WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL*"	N/A
4.4.2.2, 4-42	Sluicing operations are to be shut down in less than 15 minutes upon detection of: □ Hydrogen concentrations >5000 ppm in either tank 241-C-106 or 241-AY-102.	**ARP-T-331-00007**, "RESPOND TO WRSS DATA ACQUISITION SYSTEM COMPUTER ALARMS" **ARP-T-331-00003**, "*RESPOND TO ALARMS AT MO-211 CONTROL STATION*	N/A
	□ Ventilation failure in either tank 241-C-106 or 241-AY-102.	**TO-320-006**, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*" **ARP-T-331-00005**,"*RESPOND TO ALARMS AT ELECTRICAL EQUIPMENT SKID 241-AY-51*"	
	□ Loss of negative dome space pressure in either tank 241-C-106 or 241-AY-102.	**ARP-T-331-00007**, "RESPOND TO WRSS DATA ACQUISITION SYSTEM COMPUTER ALARMS"	
	□ Persistent and expanding foaming in tank 241-AY-102.	**TO-020-141**, "*IN-TANK VIDEO PROCEDURE*"	
4.4.3, 4-42	A minimum waiting time of 30 days between campaigns is necessary before initiating further sluicing.	**T0-320-005**, "*WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL*"	A procedure revision is required to reflect the minimum time between campaigns.
4.4.3.1, 4-43 Table 4-9, 4-43 Included in Appendix	The monitoring and sampling requirements during the monitoring period are listed in Table 4-9.	**TO-320-007**, "*OPERATE ENRAF MODEL 854 DENSITOMETER*" **7-MISC-238**, " *AY-102 ENRAF DENSITOMETER SETUP AND MAINTENANCE*" **TO-080-403**, "*SUPERNATE OR SLUDGE SAMPLING OF WASTE STORAGE TANKS*"	N/A

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		TO-080-420, "*PERFORM VAPOR GRAB SAMPLING IN THE STANDARD HYDROGEN MONITORING SYSTEM*"	
4.4.3.2, 4-45	The level rise refers to the increase in the waste level starting from the waste level immediately after completion of a campaign. This measurement must be obtained using hourly ENRAF™ data, and the baseline must be established when the potential surface motion and intermediate foaming stop (within 1 day of completion of campaign).	**TO-320-004**," *OPERATE WRSS DATA ACQUISITION SYSTEM*" **T0-320-005**, "*WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL*"	N/A
4.4.3.2, 4-45	The hydrogen concentration in the tank 241-AY-102 dome space must be baselined before the start of the first sluicing batch (1.1.1).	**TO-080-420**, "*PERFORM VAPOR GRAB SAMPLING IN THE STANDARD HYDROGEN MONITORING SYSTEM*"	N/A
4.4.4, 4-46	If significant gas retention is observed or if there is excessive uncertainty in the estimates of retained gas inventory, a void fraction measurement is required.	Void Fraction Instrument deployment work package _____	N/A
4.5.1, 4-50	During all phases of the sluicing process, leak detection instrumentation is monitored to alert operators to the presence of a leak in the WRSS equipment. Alarm functions on the leak detection instrumentation allow timely identification of a potential leak so recovery actions can be taken to mitigate the consequences of a leak.	**TO-320-006**, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*"	N/A
4.5.1.1, 4-50	Leakage from tank 241-C-106 will be determined using a combination of liquid level measurement, dry well measurement, and material balance estimates.	**TO-320-003**,"*WASTE RETRIEVAL SLUICING SYSTEM MATERIAL BALANCE*" HNF-SD-WM-PROC-021, "*TWRS PROCESS ENGINEERING INSTRUCTION MANUAL*", section 23 (Material Balance) **TF-OR-EF-C-D**, "*C, CR TANK FARMS AND 244-A DCRT LIFT STATION DAILY ROUNDS*"	N/A
4.5.1.1, 4-51	After shutdown of the slurry pumping system at the conclusion of a sluice batch, a minimum liquid level is reestablished in tank 241-C-106 that just covers the solids within the sluice zone.	This control is not implemented in WRSS procedure TO-320-006.	Procedure TO-320-006 will be modified to incorporate this control. Note , however that this is not applicable for campaign one.
4.5.1.1, 4-51	At the completion of a sluice batch, the ENRAF™ gauge will be lowered immediately into tank 241-C-106 and placed in the liquid level monitoring mode. Collection of level data will begin once the gauge is placed in service. A 24 hour	TMACS	N/A

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	baselining period will be required to allow the dynamics of the process to subside (e.g., slurry and sluicing transfer pipeline draining, solids wetting, and fog reduction). Once the baseline is established, the trend in the liquid level will be monitored and recorded.		
4.5.1.1, 4-51	For single-shell tanks equipped with an ENRAF™ level gauge that measures a liquid surface, the leak detection criteria is that a -1.3 cm (-0.5 in.) change in liquid level will prompt a leak investigation (LMHC 1996). This same criteria will apply to tank 241-C-106 during the WRSS process monitoring periods.	**TF-OR-EF-C-D,** *"C, CR TANK FARMS AND 244-A DCRT LIFT STATION DAILY ROUNDS"* **TO-320-003,** *"WASTE RETRIEVAL SLUICING SYSTEM MATERIAL BALANCE"*	N/A
4.5.1.1, 4-51	When liquid level monitoring of tank 241-C-106 is in process during the monitoring periods, video recording of the wall area of the tank using the in-tank imaging system will be required once per day.	This effort is not implemented in WRSS procedures.	Procedure **T0-320-005,** *"WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL"* section 5.3 will be modified to require the wall area video recording once per day.
4.5.1.1, 4-51	If this sloughing occurs or other liquid waste additions are made to the tank (e.g., pit flushes, ventilation filter flushes, or pipeline water flushes), a new baseline will have to be established for purposes of leak detection.	**TO-320-003,** *"WASTE RETRIEVAL SLUICING SYSTEM MATERIAL BALANCE"* HNF-SD-WM-PROC-021, *"TWRS PROCESS ENGINEERING INSTRUCTION MANUAL"*, section 23 (Material Balance)	N/A
4.5.1.1, 4-52	Both a batch material balance and a cumulative material balance will be kept during the WRSS process to monitor the progress of the sluicing operations and to provide a secondary indication of a potential leak from tank 241-C-106.	**TO-320-003,** *"WASTE RETRIEVAL SLUICING SYSTEM MATERIAL BALANCE"* HNF-SD-WM-PROC-021, *"TWRS PROCESS ENGINEERING INSTRUCTION MANUAL"*, section 23 (Material Balance)	N/A
4.5.1.1, 4-52	Actual waste volumes in tanks 241-C-106 and 241-AY-102 are obtained from the ENRAF™ level gauge measurements.	**TO-320-004,** *" OPERATE WRSS DATA ACQUISITION SYSTEM"* **TMACS**	N/A
4.5.1.1, 4-53	The data required to perform the cumulative material balance calculations are listed below. □ liquid levels in tanks 241-C-106 and 241-AY-102 at the start of sluicing (ENRAF™ level gauges)	**TO-320-004,** *" OPERATE WRSS DATA ACQUISITION SYSTEM"*	N/A

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	☐ tank 241-C-106 (during monitoring periods only) and tank 241-AY-102 liquid levels	**TO-320-004,"** ***OPERATE WRSS DATA ACQUISITION SYSTEM"***	
	☐ average waste temperatures	In-tank tank temperature data will be managed and to some extent processed via HNF-2318, Revision 0, ***"MANAGEMENT OF DATA FOR TANK 241-C-106 RETRIEVAL".***	
	☐ tank 241-AY-102 supernatant density (during monitoring periods only)	**TO-320-007,** ***"OPERATE ENRAF MODEL 854 DENSITOMETER"*** **7-MISC-238,** ***" AY-102 ENRAF DENSITOMETER SETUP AND MAINTENANCE"***	
	☐ volume of water additions and other materials	**TO-040-540,** ***"WATER SURVEILLANCE AND USAGE"***	
	☐ tank 241-C-106 ventilation exhaust flow rate; tank 241-AY-102 primary ventilation exhaust flow rate, temperature, and relative humidity; and atmospheric psychrometric condition	**TO-320-004,"** ***OPERATE WRSS DATA ACQUISITION SYSTEM"*** **TF-OR-EF-C-D,** ***"C, CR TANK FARMS AND 244-A DCRT LIFT STATION DAILY ROUNDS"*** **TF-OR-EF-AYAZ-D,** ***"AY AND AZ TANK FARMS DAILY ROUNDS"***	
	☐ tank 241-C-105 dome space temperature (tank monitoring and control system)	TMACS	
	☐ tank 241-C-106 and 241-AY-102 dome space pressures	**TO-320-004,"** ***OPERATE WRSS DATA ACQUISITION SYSTEM"*** **TF-OR-EF-C-D,** ***"C, CR TANK FARMS AND 244-A DCRT LIFT STATION DAILY ROUNDS"***	
	☐ 296-C-006 ventilation system condenser upstream pressure, pressure drop, and downstream temperature.	**TF-OR-WRSS-C-1,** ***"C-FARM WRSS EQUIPMENT ROUNDS"***	
4.5.1.3, 4-56	Leak detection elements are installed at the lower end of the secondary containment pipes to actuate an alarm and an	**ARP-T-331-00005,"***RESPOND TO ALARMS AT ELECTRICAL EQUIPMENT SKID 241-AY-51"*	N/A

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	annunciator light in the control room if a leak is detected (see Section 3.5.3.2).		
4.5.4, 4-57	To confirm that the oil interacts as anticipated during the WRSS process, the supernatant surface in tank 241-AY-102 will be sampled periodically.	N/A	N/A
4.5.4, 4-57	One sample will be taken following each of the increments. Additionally, the surface of the waste will be inspected for an oil slick during monitoring periods using the mobile color camera system.	**TO-080-420**, "*PERFORM VAPOR GRAB SAMPLING IN THE STANDARD HYDROGEN MONITORING SYSTEM* **T0-080-403**, "*SUPERNATE OR SLUDGE SAMPLING OF WASTE STORAGE TANKS*" **TO-020-141**,"*IN-TANK VIDEO PROCEDURE*"	N/A
4.6, 4-58	All sampling events will be made from the same location at riser 15-N.	**T0-080-403**, "*SUPERNATE OR SLUDGE SAMPLING OF WASTE STORAGE TANKS*"	Work Package will provide riser location.
5.1.1, 5-1	If the calculated pre-sluicing subcooling margin is reduced at any time during the sluicing operations or if sluicing shutdown is anticipated to extend beyond 20 days, ventilation of the tank will be aligned to operate the 296-P-16 exhauster and the inlet air chiller system. Air cooled to 4.4 °C (40 °F) will ventilate the tank until sluicing start up is desired and the required subcooling is achieved. The response to this off-normal event is applicable only for the first campaign.	**T0-320-005**, "*WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL*"	N/A
5.1.2, 5-2	The response to the off-normal event where the predicted tank 241-AY-102 steady-state temperatures exceed the LCS/LCO 3.3.2 limits because a high total heat load is as follows. 1. Shutdown sluicing operations, if under way. 2. Continue to monitor the instrumentation required to collect the data needed for performing thermal analysis (see Section 4.3.2.3). The purpose of this monitoring is to determine if the physical	**TO-320-006**, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*" **TO-320-004**," *OPERATE WRSS DATA ACQUISITION SYSTEM*" **TF-OR-EF-C-D**, "*C, CR TANK FARMS AND 244-A DCRT LIFT STATION DAILY ROUNDS*" **TO-320-004**," *OPERATE WRSS DATA*	N/A

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	parameters (i.e., waste fluffing and thermal conductivity) important to the thermal behavior of the tank become more favorable. As the sludge continues to consolidate and compact in the tank bottom, the waste fluffing will decrease and the thermal conductivity will increase. Both of these trends will improve heat transfer and consequently lower steady-state temperatures.	*ACQUISITION SYSTEM"* TMACS TF-OR-WRSS-C, "*C-FARM WRSS OPERATIONS ROUNDS*"	
	3. Calculate steady-state temperatures once every 15 days using the WRSS thermal models and compare results with the temperature limits of Table 4-7 or 91 °C (195 °F), if supernatant has been removed to below 4.6 m (180 in.) after completing the first increment. The thermal modeling results will be reviewed by the Tank 241-C-106 Waste Retrieval Technical Review Group and a decision made to either proceed with sluicing, continue monitoring/evaluation activities or implement mitigating actions.	Thermal Analysis Report	No Procedure Required
	4. Upon a recommendation of the TRG to implement mitigating actions, either a backup air blower will be installed to increase the annulus bottom flow channel cooling capacity (i.e.,increase air flow rate to 1,200 cfm) or the blower together with an inlet air chiller will be installed. A thermal analysis using the most current waste properties will determine the level of modification required and the time available for installing and starting up the equipment.	Thermal Analysis Report used as bases for design decision on potential need for further enhanced annulus ventilation alternatives.	
5.1.3.1, 5-3	Off-normal conditions during sluicing operations include: detection of hydrogen concentrations greater than 5,000 ppm	TO-320-006, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*"	N/A

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	in either tank 241-C-106 or tank 241-AY-102, ventilation failure in either tank, loss of negative pressure in either tank, and detection of excessive foaming in tank 241-AY-102. As noted in Section 4.4.2.2, the sluicing operations are required to be shut down in less than 15 minutes if any of these conditions arise. Operations should be restarted only after verifying that dome hydrogen concentrations are less than 500 ppm in both tanks.	**T0-320-005, "*WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL*"**	
5.1.3.3, 5-4	If high void retention in tank 241-AY-102 is indicated, deployment of the void fraction instrument (VFI) must be considered as a means to verify the void fraction. A contingency plan for deployment of the VFI will be in place before sluicing begins (FDH 1998a and Pasamethetoglu et al. 1997).	Void Fraction Instrument work package	N/A
5.1.4, 5-4	In the unlikely event that design features and operating process controls are unsuccessful in preventing a pipeline plug, the following graded approach will be implemented as required to clear the plug from the pipeline. 1. At the tank 241-AY-102 end of the transfer pipeline, the cover block plug over the flush connection nozzle will be removed and the flush adapter installed. Pressurized hot water (maximum allowable pressure is 2,206 kPa [320 psig]) is used to remove the plug. 2. The tank 241-C-106 end pit is opened and the associated jumper is removed. A pressure test jumper is connected to the plugged transfer line and pressurized hot water (maximum allowable pressure is 2,206 kPa [320 psig]) is used to remove the plug. 3. A commercially available hydrolase system will be installed to remove the plug. The hydrolase systems are special, moderate-pressure to high-pressure spray heads attached to a flexible hose. These	**TO-320-014, " *FLUSH WRSS TRANSFER LINES*"** If ever required items two through four would be pursued using a work package.	N/A

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	systems are inserted into the pipeline until the spray head is in contact with the plug material. Water is then forced through the spray head to dislodge and flush the plug solids from the transfer pipeline. Because of the free-draining nature of the hydrolysing process, any pressure increase in the transfer pipeline will be limited to the design pressure of 2,206 kPa (320 psig). 4. If all attempts to remove the plug fail, bypassing the plugged section of the pipeline will be considered. In replacing the pipe section, ALARA considerations are assessed, the obstruction is located by gamma assay (or other methods), and confinement barriers are placed around the area. Waste containment considerations are also assessed before excavating the berm, cutting and removing the pipeline, and replacing and welding the new pipe section.		
5.1.6, 5-7	If a 49 °C (120 °F) tank 241-AY-102 supernatant temperature could be reached, which is highly unlikely, sluicing operations would be shut down while the tank ventilation systems operate to dissipate the high temperature condition.	T0-060-050," *OPERATE 296-P-16 EXHAUSTER*" TO-320-009,"*OPERATE WRSS 296-C-006 HVAC SYSTEM*"	Implement 120° F alarm for DAS.
5.2.1, 5-7	If the tank 241-C-106 ventilation system (296-C-006) becomes inoperable for any reason, shut down of sluicing operations including the transfer pump systems will begin immediately. Follow the procedure outlined in Section 4.1.5 for transfer pipeline flushing.	TO-320-006, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*" TO-320-014, "*FLUSH WRSS TRANSFER LINES*"	N/A
5.2.2, 5-7	If the tank 241-AY-102 primary ventilation system (241-AZ-702) becomes inoperable for any reason, shut down of sluicing operations will begin immediately and be completed in less than 15 minutes.....	TO-320-006, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*"	N/A

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5.2.2, 5-7	If the ventilation system cannot be restarted immediately, a portable exhauster will be connected to a tank riser to provide interim ventilation…….	In the event of an off-normal loss of ventilation event, portable exhausters are placed in use and operated per procedures **T0-060-047, TO-060-048,** and **TO-060-049** *"OPERATE EMERGENCY BACKUP 241-C-106 EXHAUSTER", "OPERATE EMERGENCY BACKUP 241-AY-102 EXHAUSTER", "OPERATE EMERGENCY BACKUP 241-AY-102 ANNULUS EXHAUSTER"* respectively.	N/A
5.2.3, 5-8	If the ventilation system cannot be restarted immediately, a portable exhauster will be connected to a tank riser to provide interim ventilation	In the event of an off-normal loss of ventilation event, portable exhausters are placed in use and operated per procedures **T0-060-047, TO-060-048,** and **TO-060-049** *"OPERATE EMERGENCY BACKUP 241-C-106 EXHAUSTER", "OPERATE EMERGENCY BACKUP 241-AY-102 EXHAUSTER", "OPERATE EMERGENCY BACKUP 241-AY-102 ANNULUS EXHAUSTER"* respectively.	
5.2.4, 5-8	If power cannot be immediately restored to the ventilation systems, actions required to connect the portable exhausters will be initiated to provide interim ventilation (see Sections 5.2.1, 5.2.2, and 5.2.3). The priority for use of the portable exhauster is as follows. 1. Tank 241-C-106, if the remaining heat load is greater than 50,500 Btu/hr (Ogden et al. 1998). 2. Tank 241-AY-102 annulus. 3. Tank 241-AY-102 primary tank.	**In the event of an off-normal loss of ventilation event, portable exhausters are placed in use and operated per procedures** T0-060-047, TO-060-048, **and** TO-060-049 *"OPERATE EMERGENCY BACKUP 241-C-106 EXHAUSTER", "OPERATE EMERGENCY BACKUP 241-AY-102 EXHAUSTER", "OPERATE EMERGENCY BACKUP 241-AY-102 ANNULUS EXHAUSTER"* **respectively.**	
5.2.6.2, 5-10	If a potential leak from tank 241-AY-102 is detected, shut down of sluicing operations will begin immediately and be completed in less than 15 minutes following the procedure outlined in Section 4.1.1. The recovery actions of LCO 3.2.6, "Primary Tank Leak Detection System," will also be implemented (FDH 1998b). Sluicing shall not restart unless the detected leak in determined to be a false-positive event. In the event of a tank 241-AY-102 leak is verified, actions will be taken to place the tank in the safest possible	**TO-320-006,** *"TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS"*	

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	condition while follow-on actions are determined in consultation with the DOE-RL and Ecology.		
5.2.6.3, 5-10	If a leak from the WRSS transfer pipeline system is detected, shut down of sluicing operations will occur immediately (i.e., the routine pipeline flushing procedure will not be performed). Emergency response procedures which implement AC 5.14 of the TWRS technical safety requirements (FDH 1998b) are also activated. A decision on whether to perform a water flush of the pipelines will be evaluated and incorporated as appropriate into the approved recovery plan.	**TO-320-006**, "*TK-241-C-106 WASTE RETRIEVAL SLUICING SYSTEM SLUICING OPERATIONS*" **T0-320-005**, "*WASTE RETRIEVAL SLUICING SYSTEM STARTUP AND PROCESS CONTROL*"	

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