Receipt and Processing of RBOF/RRF Liquid Waste in H-Tank Farm (U)

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RECEIPT AND PROCESSING OF RBOF/RRF LIQUID WASTE IN H-TANK FARM (U)

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INTRODUCTION AND SUMMARY

The Receiving Basin for Off-Site Fuels/Resin Regeneration Facility (RBOF/RRF) currently generates approximately 50,000 gallons of wastewater per month. This waste is sent to the 211-H General Purpose (GP) evaporator and/or the 241-H Tank Farm (HTF). The primary criteria for selecting the destination of the waste are solids content and radioactivity. The waste is typically sent to the GP evaporator if it has low solids content and low activity. High activity and/or high-solids content waste is sent to HTF (Tank 21H or Tank 23H depending on activity level). Currently, approximately 70% of the waste water produced at RBOF/RRF meets the criteria for acceptance by the GP evaporator.

In June 1993, High Level Waste Engineering (HLWE) opened a Technical Issue (HLE-TI-93-024) related to processing of RBOF/RRF directly through the 1H Cesium Removal Column (CRC) to the F/H Effluent Treatment Facility (ETF). This issue was raised due to uncertainties associated with operation of the 1H Evaporator. In March 1994, additional emphasis was placed on this effort after it was determined that the 1H evaporator had a failed tube bundle. As a result, HLE-TI-93-024 was expanded to include evaluations of methods to increase the acceptance rate of RBOF/RRF wastewater at the GP (i.e., to ensure that the 70% of RBOF/RRF wastewater that currently meets the GP acceptance criteria is actually processed at the GP).

Since March 1994, significant progress has been made to increase the operating efficiency of the GP evaporator for processing RBOF/RRF wastewater. This operating efficiency increase is due to increased coordination between RBOF/RRF and GP evaporator personnel and efforts to increase the staging capacity for storing RBOF/RRF wastewater at 211-H. Since March 1994, waste receipts from RBOF/RRF have averaged less than the 30,000 gallons/month allotted in the HLW System Plan. In addition, the RBOF/RRF waste sent to HTF has successfully been processed through the 2H evaporator. Based on this progress, no additional effort should be expended to reduce the amount of RBOF/RRF sent to HTF, either by increasing the criteria for acceptance of RBOF/RRF waste at the GP evaporator or by evaluating alternate treatment options (such as processing through the 1H CRC or installing treatment equipment in the RBOF/RRF).

DISCUSSION

RBOF/RRF Waste Streams

Handling of wastewater produced at the RBOF/RRF Facility is controlled by procedure.¹ Specifically, this procedure addresses the RBOF/RRF waste streams

shown in Table I. Table I also lists the potential destination(s) for these waste streams as specified in procedure 244-H-1011.

Table I
RBOF/RRF Waste Streams and Destination

<u>RBOF/RRF Waste Type</u>	<u>Destination</u>
Filter Backflush (FB)	Tank 21H (21) or Tank 23H (23)
Harp Flush (HF)	21 or 23
Caustic Flush (CF)	23
Oxalic Acid Flush (OF)	23
Transfer Solution (TS)	GP Evaporator (GP), 21, or 23
Resin Classification (RC)	GP, 21, or 23
Resin Regeneration (RR)	GP, 21, or 23
Deionizer Rinses (DR)	GP, 21, or 23
Final Rinse (FR)	GP, 21, or 23
Cask Wash Pit Solution (CWP)	GP, 21, or 23
Cell Sump (CS)	GP, 21, or 23
Rainwater (MS)	GP, 21, or 23

The final destination of waste that can be received either at the GP Evaporator, Tank 21H, or Tank 23H is determined largely by activity level and the availability of the GP evaporator to process the wastewater. Approximately 70% of the wastewater currently generated by the RBOF/RRF meets the criteria for acceptance at the GP evaporator.

The four types of RBOF/RRF waste (FB, HF, CF, OF) that can only be sent to the HTF are restricted from the GP evaporator due to high solids content. Although neither the RBOF/RRF Waste Handling procedure¹ or the 211-H waste receipt procedure² specify a maximum value on solids content of waste sent to the GP evaporator, previous operating history has shown that processing these four types of waste at the GP results in operational problems. Determination of the final destination in HTF (i.e., Tank 21 or 23) is determined largely by activity level. All waste sent to Tank 21 or Tank 23 must meet the HLW Liquid Waste Acceptance Criteria.³

A schematic diagram of the process flow for RBOF/RRF wastewater is shown in Figure 1.

Open Technical Issue HLE-TI-93-024

In June 1993, High Level Waste Engineering (HLWE) opened a Technical Issue (HLE-TI-93-024) related to processing of RBOF/RRF directly through the 1H Cesium Removal Column (CRC) to the F/H Effluent Treatment Facility (ETF).

This issue was opened due to concerns with the operation of the 1H Evaporator and followed-up on a previously drafted Test Authorization (TA) to operate the 1H CRC with a recently developed resorcinol-formaldehyde resin. In the spring of 1994 concerns were raised about the ability of the tank farms to produce the space available in Type III tanks (3,000,000 gallons) necessary to support the start-up of the Defense Waste Processing Facility (DWPF). These concerns were increased when it was discovered that the 1H Evaporator had a failed tube bundle. As a result, HLE-TI-93-024 was broadened to generally address the need to reduce the impact of RBOF-RRF waste transfer on Type III waste tank available space to zero. Three activities were identified to minimize the impact of RBOF/RRF waste transfers on Type III tank available space.

1. Maximize the Efficiency of the GP Evaporator for Processing RBOF/RRF Waste.
2. Evaluate Options for Processing RBOF/RRF Waste Directly Through the 1H CRC to ETF (the original intent of HLE-TI-93-024), and
3. Evaluate Alternate Processing Options for RBOF/RRF Waste Effluent.

Each of these activities is briefly described below.

1. Maximize the Efficiency of the GP Evaporator for Processing RBOF/RRF Waste

Several actions were identified to increase the acceptance rate for RBOF/RRF waste at the GP Evaporator.^{4,5} Each of these activities is described briefly below. A Performance Indicator has been developed to track RBOF/RRF Waste transfers to the tank farm (Figure 2).

1.1. Increase Coordination Between RBOF/RRF & 211-H Outside Facilities.

The primary goal of this activity is to drive the RBOF waste acceptance rate at the GP to 100%. That is, all of the RBOF/RRF waste that meets the GP Evaporator acceptance criteria is actually processed at the GP. As seen in the Performance Indicator (Figure 2), since the original meetings between HLW, RBOF, and GP personnel in March 1994, the acceptance rate at the GP has increased significantly. Steam problems and resultant backlog of GP feed are responsible for the low rate of acceptance in July. Other factors (i.e. - lack of adequate staging area, burner feed streams, etc.) will continue to limit the acceptance rate of RBOF waste at the GP and are being addressed separately. However, over the last several months, the RBOF/RRF waste transfers to HTF have been below the 30,000 gallons/month currently forecast in the HLW System Plan.⁶

1.2. Increase Staging Area @ 211-H

Efforts are currently underway to convert Tank 716 at 211-H to a staging vessel for RBOF waste. Several problems were identified during walkdowns of the initial design that have delayed work on this task. These problems have been corrected and work to implement this design is in progress. This work will continue. Scheduled modifications to Tank 716 are scheduled to be complete by 3/31/95.

1.3. Remove Restrictions on 211-H Bottoms Transfers

Another factor which limits the ability of the GP to process RBOF waste is the ability to transfer the bottoms from the GP to H-Tank Farm. These restrictions are primarily due to construction activities at HDB-7. Since the initial meetings in March 1994, coordination between GP and HTF personnel has improved significantly and restrictions on GP bottoms transfers are no longer a limiting factor on processing RBOF waste at the GP.

The Performance Indicator on RBOF/RRF waste transfers is updated monthly by HLWE. A 75% acceptance rate by the GP evaporator has been established as the goal for RBOF/RRF waste. Should the acceptance rate drop below 75% (without obvious reason, i.e., shutdown of the GP evaporator) or the volume of RBOF/RRF waste exceed the HLW System Plan⁶ forecast for consecutive months, a new Technical Issue will be opened. As specified by the HLW Waste Acceptance Criteria,³ quarterly Waste Generator Coordination Meetings will be held with RBOF/RRF and Separations personnel.

2. Evaluate Options for Processing RBOF/RRF Waste Directly Through the 1H CRC to ETF

As discussed previously, the original intent of Open Technical Issue HLE-TI-93-024 was related to processing the RBOF/RRF waste that is sent to Tank 23H through the 1H Cesium Removal Column (CRC). This option bypasses the evaporator and, therefore, does not impact space available in Type III waste tanks. In this option, the RBOF/RRF waste is mixed with the 1H overheads and then processed through the 1H CRC. The CRC typically operates with a "charge" of zeolite. Previously, when the RBOF/RRF stream was processed through the CRC, performance of the CRC was less than adequate. The column reached a high dP after processing a small number of bed volumes. It was postulated that the high dP was due either to degradation of the zeolite or plugging of the CRC with solids entrained in the stream. Zeolite degradation was believed to be the primary factor contributing to the poor CRC performance, however, a formal evaluation of the zeolite degradation was not performed. It was suggested that

the high pH of the RBOF/RRF waste stream (~14) contributed to the zeolite degradation. Zeolite is known to degrade at high pH.

About that same time, the resorcinol-formaldehyde resin was becoming available. It was suggested to replace the zeolite "charge" with the new resin. This was viewed as a way around the zeolite degradation issue and may have allowed processing directly to the CRC (without blending with 1H overheads). A Test Authorization was prepared for this option, but was never approved. The primary problem with the use of the resorcinol-formaldehyde resin in the CRC is that the only (reasonable) way to remove the resin from the CRC is to open up the drain valve and allow it to drain to the waste tank. Adding this amount of organic to the tank goes beyond current practice and requires careful consideration.

Since the last time RBOF waste was processed through the CRC, the procedures have been modified so that RBOF now neutralizes only to pH 10 - 12. West Valley Nuclear Services (WVNS) current operates a zeolite column at low pH (~12) and low temperature (~10 °C) and obtains excellent bed-life. Although the 1H CRC operates at near-ambient temperatures (20 - 30 °C), it was determined the reduction in pH may reduce the amount of zeolite degradation. Based on this, it was recommended that a field trial be conducted to evaluate the performance of the zeolite and the ability of the CRC to "direct process" RBOF/RRF waste to the ETF. Several efforts were undertaken to return the 1H CRC to service. Progress on this field trial was delayed by priorities associated with the 2H evaporator restart and difficulties in pressure testing the CRC lines due to leaky valves.

However, even if the field tests showed that the CRC performed acceptably, it is still necessary to "dump" the zeolite to the waste tank when the column performance degrades. Although several tanks currently contain large quantities of zeolite, removal and processing this material through the DWPF is currently an Open Technical Issue.⁷ In addition, as discussed above, much of the RBOF/RRF waste contained in Tank 23H has successfully been processed through the 2H evaporator. Based on the successful performance of the 2H evaporator, and the reduction in RBOF/RRF waste sent to HTF, the field test to evaluate the performance of the zeolite CRC is not warranted at this time. It is recommended that efforts to return the 1H CRC to service (solely for processing RBOF/RRF waste) be deferred.

3. Evaluate Alternate Processing Options for RBOF/RRF Waste Effluent.

A number of alternative processing options for the RBOF/RRF waste effluent were also considered and are briefly described below.

3.1. Evaluate GP Evaporator Acceptance Criteria

As discussed previously, the primary factor that limits acceptance of RBOF/RRF waste at the GP Evaporator is solids content. However, none of the procedures^{2,3,8-9} related to the transfer and receipt of RBOF/RRF waste make specific reference to the solids content of the waste, nor is the solid content measured prior to transfer. As shown in Table I, the RBOF/RRF waste transfer procedure does specify which types of waste produced at RBOF/RRF can be transferred to the GP Evaporator. These wastes are primarily restricted from the GP due to the fact that they are generated from operations that produce solids in the liquid effluent. In the past, processing these types of wastes at the GP has resulted in operational problems. In order to process additional RBOF/RRF waste at the GP Evaporator, the maximum solids content of waste sent to the GP Evaporator would have to be quantitatively defined. In addition, the solids content of the RBOF/RRF would have to be determined before sending the waste to the GP Evaporator.

3.2. "Direct" Processing RBOF/RRF Waste at the F/H ETF

Some of the waste produced by RBOF/RRF could be processed at the ETF. Although the activity limits for transfer of waste to ETF ($<5,000$ d/m/ml) are far less than those for the GP Evaporator ($<400,000$ d/m/ml), it may be possible to process a significant portion of the RBOF/RRF waste at the ETF if the ETF acceptance criteria¹⁰ can be relaxed or if the RBOF waste can be mixed with other lower activity waste at the ETF. In order to accomplish this, a detailed evaluation of the ETF acceptance criteria and characterization of the RBOF/RRF waste streams for chemical inventory, radionuclides, etc. would need to be performed. In addition, transfer capability directly from RBOF/RRF to the ETF does not currently exist. Further, since the ETF is a South Carolina Department of Health and Environmental Control (SCDHEC) permitted facility, revision of the ETF permit may be required before RBOF/RRF waste could be processed at the ETF.

3.3. Installation of Waste Processing Capability at RBOF

As part of the Office of Technology Development (OTD) activities funded by DOE EM-50, several Compact Processing Units (CPUs) are being developed which could be installed at RBOF/RRF to process wastewater in the RBOF/RRF facility. The CPUs currently being developed include skid-mounted ion exchange and evaporator units. These units could be used to reduce the activity and volume of the RBOF/RRF stream prior to transfer. These CPUs are currently in the

design and testing stage and, as such, are not available for production use. As the CPUs continue to be developed, their use at RBOF/RRF should continue to be evaluated.

Further development of any of these options would require a significant investment of manpower and potential equipment and design changes. Again, based on the successful performance of the 2H evaporator, and the reduction in RBOF/RRF waste sent to HTF, additional effort to implement any of these alternative processing options is not warranted at this time.

CONCLUSIONS

Significant progress has been made to increase the operating efficiency of the GP Evaporator for processing RBOF/RRF wastewater. This operating efficiency increase is due to increased coordination between RBOF/RRF and GP evaporator personnel and efforts to increase the staging capacity for storing RBOF/RRF wastewater at 211-H. Since March 1994, waste receipts from RBOF/RRF have averaged less than the 30,000 gallons/month allotted in the HLW System Plan. In addition, the RBOF/RRF waste sent to HTF has successfully been processed through the 2H evaporator. Based on this progress, it is recommended that additional effort to reduce the amount of RBOF/RRF sent to HTF, either by increasing the criteria for acceptance of RBOF/RRF waste at the GP evaporator or evaluating alternate treatment options (such as processing through the 1H CRC or installing treatment equipment in the RBOF/RRF) be deferred.

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2. Procedure 211-H-4025, "Building 211-H Waste Transfers (U)," Rev. 14, July 7, 1994.
3. G.K. Georgetown, "Criteria for Acceptance of High level Liquid Waste into the 241-F/H Tank Farms (U)," X-SD-G-00001, Rev. 0, April 22, 1994.
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6. N.R. Davis, "HLW System Plan - Revision 3 (U)," HLW-OVP-94-007, May 31, 1994.
7. Open Technical Issue WRE-019, "Equipment and Heel Removal."
8. Procedure 241-1H-601, "Receiving Liquid Waste from RBOF-RRF (U)," Rev. 14, January 15, 1994.
9. Procedure 241-1H-601A, "Liquid Waste from RBOF-RRF Worksheet (U)," Rev. 4, January 14, 1994.
10. Waste Acceptance Criteria for the F/H Effluent Treatment Facility (ETF) are Currently in Development.

Figure 1

Schematic Diagram of RBOF/RRF Waste Processing Flow

Figure 2

Performance Indicator - RBOF/RRF Waste Transfers to H-Tank Farm

2a - Volume Transferred - Calendar Year 1994 To-Date

2b - Acceptance Rate at 211-H GP Evaporator (By Volume)

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