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Tank 25 Deliquification Summary

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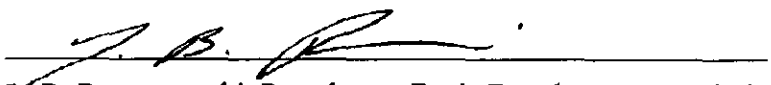

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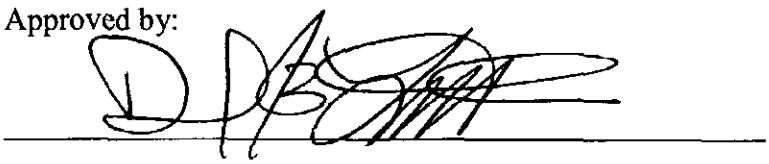

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Summary

Revision 0 of this report documented the completion of deliquification (interstitial liquid removal) from Tank 25. Revision 1 incorporates data from additional interstitial liquid removal transfer attempts performed while awaiting initiation of salt dissolution activities in Tank 25.

Revision 0 states that salt dissolution activities should not be delayed for the purpose of removing additional interstitial liquid. If salt dissolution is delayed, attempts to remove additional interstitial liquid will be performed. Salt dissolution in Tank 25 has been delayed since completion of deliquification. Four additional interstitial liquid removal transfers have been completed since the completion of deliquification. Each of the last two transfers removed an additional 100 gallons of interstitial liquid. The starting and ending well level remained unchanged for these interstitial liquid removal transfers indicating little additional interstitial liquid was removed.

During the deliquification process and additional transfers, approximately 286 kgal of liquid was removed from Tank 25 and transferred to Tank 34. This volume consists of approximately 251 kgal of supernate and interstitial liquid with the remaining being flushwater added during the process.

To achieve planned salt processing objectives, initiation of bulk salt dissolution activities on Tank 25 are underway. Therefore, additional interstitial liquid removal transfers will not be performed. Initial activities include completion of the FDB-2 transfer facility upgrades (supporting salt transfer capabilities), removal of the Tank 25 interstitial liquid removal pump, installation of the salt solution pump, and initiation of the Tank 25 Salt Dissolution Management Checklist.

Deliquification Summary

To support the future processing objectives for the Savannah River Site Liquid (Radioactive) Waste System, Tank 25 is being converted so that it can be used as the concentrate receipt tank for the 2F Evaporator System. Conversion of Tank 25 for this purpose requires that a portion of the saltcake currently stored in the tank be removed by dissolution and transferred to other tanks.

In preparation for the dissolution and removal of saltcake from Tank 25, the tank underwent the deliquification process which involved removing the supernate from above the saltcake and extracting interstitial liquid from within the saltcake matrix. Deliquification was initiated in March 2005 with removal of the supernate from above the saltcake. This material was transferred to Tank 34 and will be stored for future processing through the Salt Waste Processing Facility (SWPF). After removal of the supernate, a new pumping system was installed in the tank and removal of interstitial liquid was initiated. Removal of the interstitial liquid was started in October 2006 and continued into February 2007. The material removed during interstitial draining was also transferred to Tank 34 and will be stored for future processing through SWPF. During the deliquification process approximately 263 kgal of liquid was removed from Tank 25 and transferred to Tank 34. This volume consisted of approximately 235 kgal of

supernate and interstitial liquid with the remaining being flushwater added during the deliquification process.

Interstitial liquid removal operations in Tank 25 have reached a point where the liquid level in the well is being pumped down to the minimum level possible and there is no longer appreciable flow of interstitial liquid into the salt well. The volume of liquid that can be removed by running the pump is essentially equal to the volume of flushwater that must be added to sustain operations. Tank 25 interstitial liquid removal has reached a practical limit where continued attempts to remove material will result in a limited amount of additional interstitial liquid being removed while continuing to add flushwater into the Liquid Waste System. Deliquification of Tank 25 has reached the point where interstitial liquid has been removed to the maximum extent practical when considering the significant quantities of additional flush water added to the system with negligible additional interstitial removed and, therefore, salt dissolution activities in Tank 25 should not be delayed for the purpose of removing additional interstitial liquid. Over long periods of time, additional interstitial liquid may continue to drain into the salt well, however, the volume of material is expected to be small and the amount that will be able to be removed will be limited. If salt dissolution activities in Tank 25 are delayed for other reasons, the liquid level in the tank will be monitored and attempts to remove additional interstitial liquid may be performed at thirty to forty-five day intervals if interstitial draining equipment remains operable and transfers can be sustained.

With the completion of interstitial liquid removal, Tank 25 is now ready to proceed into the dissolution phase when required to support the Liquid Waste System processing objectives. Based on current plans, the salt solution resulting from dissolution of Tank 25 saltcake will be treated through the Actinide Removal Process (ARP) and Modular Caustic Side Solvent Extraction (CSSX) Unit (MCU) prior to being solidified into a grout matrix and disposed in the Saltstone Disposal Facility (SDF) vaults.

Additional Interstitial Liquid Transfer Summary

Four additional interstitial liquid transfers have been performed in the 11 months since the completion of the deliquification process. With the vast majority of interstitial liquid removed during the deliquification process, the final four transfers maximized the removal of the interstitial liquid that slowly drained into the pump well between transfers. Each transfer was separated by over 1,000 hours to allow interstitial liquid to drain into the well to be pumped out. The total drain time for the four transfers was approximately 5,400 hours. Approximately 23,000 gallons was removed during the four transfers, 7,000 gallons was added to support the process, resulting in a net of approximately 16,000 gallons of interstitial liquid removed in the 5,400 drain hours. The last two transfers, after drain times of approximately 1,100 and 1,400 hours respectfully, resulted in removing approximately 100 gallons each of interstitial liquid. The well level recovered to 77 inches after the completion of the deliquification process and just prior to the first additional transfer. The forth transfer was performed on October 6, 2007. The well recovery time has been 2,200 hours since completion of the forth transfer and up to January 6, 2008 and the well has recovered to approximately 77 inches. This is the same

level that the well recovered to after deliquification completion and prior to the first additional transfers indicating little additional interstitial liquid was removed.

1 Purpose

The purpose of this document is to summarize the deliquification activities carried out in Tank 25 in preparation for salt dissolution and removal.

2 Introduction

The ability of the 2F Evaporator System to operate efficiently and support the future processing objectives for the Savannah River Site Liquid (Radioactive) Waste System, including, continued sludge batch preparation, tank closures, salt disposition activities and nuclear material stabilization from H-Canyon, is being impacted by the limited space available in Tank 27, the current 2F evaporator concentrate receipt tank. In order to support these processing objectives in the future, Tank 25 is being converted so that it can be used as the 2F Evaporator concentrate receipt tank. Conversion of Tank 25 for this purpose requires that a portion of the saltcake currently stored in the tank be removed by dissolution and transfer to other tanks.

In preparation for the dissolution and removal of saltcake from Tank 25, the tank underwent the deliquification process as outlined in the *Basis for Section 3116 Determination for Salt Waste Disposal at the Savannah River Site*[1]. The deliquification process involves removal of the supernate from above the saltcake and extraction of interstitial liquid from within the saltcake matrix. Deliquification was initiated in March 2005 with removal of the supernate from above the saltcake. This material was transferred to Tank 34 and will be stored for future processing through the Salt Waste Processing Facility (SWPF). After removal of the supernate from above the saltcake, the existing transfer jet was removed and a new pumping system was installed in the tank. Removal of the interstitial liquid was started in October 2006 and completed in February 2007. The material removed during interstitial draining was transferred to Tank 34 and will also be stored for future processing through SWPF. With the completion of interstitial liquid removal, Tank 25 is now ready to proceed into the dissolution phase when required to support the Liquid Waste system disposition processing objectives. Based on current plans outlined in the Disposition Processing Plan[2] (DPP), the salt solution resulting from dissolution of Tank 25 saltcake will be processed through the Actinide Removal Process (ARP) and Modular Caustic Side Solvent Extraction (CSSX) Unit (MCU) prior to being solidified into a grout matrix and disposed of in the Saltstone Disposal Facility (SDF) vaults. As discussed in the *Basis for Section 3116 Determination for Salt Waste Disposal at the Savannah River Site*[1] and in more detail in the response to Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) Comment #12[3], Tank 25 was selected in part because it has one of the lowest Cs-137 concentrations in the supernate/interstitial liquid, resulting in less total activity sent to the SDF vaults.

2.1 Assumptions

Tank 25 is a Type III tank located in F-Area. Based on early projections, it was estimated that the tank contained approximately 160 kgal[4] of supernate above the saltcake and approximately 1,100 kgal[4] of saltcake. These volumes were determined based on an initial liquid level of approximately 362 inches and an estimated saltcake level of approximately 316 inches.

To project the expected volumes during the deliquification campaign, Tank 25 saltcake was assumed[5] to have similar properties as the Tank 41 saltcake. Below, in Table 1, are a few of the assumptions used in, and results obtained from, the interstitial draining modeling performed at the Savannah River National Laboratory (SRNL). The Tank 25 flowsheet is based on the nominal case.

Table 1 – Range of Model Input Assumptions and Drainable Liquid Projections

	Minimum	Nominal	Maximum
Total saltcake void:	NA	40%	NA
Liquid fraction:	15%	30%	40%
Gas fraction:	25%	10%	0%
Drainable liquid fraction:	10%	15%	25%
Pump Suction:	12 inches	20 inches	60 inches
Capillary Fringe:	NA	36 inches	NA
Free liquid:	NA	161,000 gal	NA
Interstitial liquid:	182,000 gal	333,000 gal	460,000 gal
Drainable interstitial liquid:	75,000 gal	136,000 gal	230,000 gal

As discussed, the values listed above represent a nominal case assuming the physical saltcake properties in Tank 25 are the same as those found in Tank 41. As can be seen in Table 1 (above), the volume of interstitial liquid that can be readily removed from Tank 25 was projected to be from 75 kgal to 230 kgal given the variability already known to exist within physical properties of Savannah River Site saltcake[5].

Following sections describe the different phases of the deliquification process in Tank 25:

3 Supernate Removal

Deliquification of Tank 25 was initiated on March 16-17, 2005, when approximately 128,000 gal of supernate was transferred to Tank 34 using the installed Tank 25 jet, which had a suction level of 288 inches from the tank bottom. The liquid level in Tank

25 decreased from 359.3 inches on March 15th to 323.8 inches on March 18th [6]. The transfer was stopped just prior to exposing the saltcake surface. The material transferred to Tank 34 will be stored for future processing through the SWPF.

4 Interstitial Liquid Pump Installation

In April 2005, the existing transfer jet was removed and a caisson was installed into Tank 25 to provide a salt well for the interstitial liquid pump. The caisson is designed to rest on the tank bottom and allows for positioning of the pump as close to the tank bottom as possible. In September 2006, the interstitial liquid pumping system was installed in the tank. Due to interferences in the caisson, the pump was not able to be positioned at the bottom of the caisson and it is estimated that the pump suction was at a height of approximately 56 inches from the tank bottom. It was decided that interstitial liquid removal would be initiated with the pump at the higher elevation, however, the pump would be required to be lowered in order to complete interstitial drainage. Initial interstitial liquid removal was performed with the first pumping system, however, shortly after initial startup, problems were encountered with the pump and the pump was replaced. Installation of the second pump was successful at placing the pumping assembly at the bottom of the caisson. Based on the design of the low flow pump, which requires the motor to be positioned below the pump head to allow for product cooling of the motor, the pump suction elevation was approximately 26 inches from the tank bottom. A pump with a lower suction elevation that also met flow and head requirements could not be identified. The second pumping system was used for the remainder of the interstitial liquid removal campaign, including the additional interstitial liquid transfers, and was still operable as of the writing of this report.

5 Interstitial Liquid Removal

Draining of the interstitial liquid started on October 20, 2006 with an initial tank liquid level of 319.1 inches. (Note: On October 12, 2006, the tank reel tape system was 'standardized' which corrected the reel tape level readings) This standardization accounts for the difference between the levels reported at the end of free supernate removal, 323.8 inches, and the beginning of interstitial removal. No additional material was removed during this time period. The amount of free supernate above the saltcake remaining to be transferred at this time was approximately 5,000 gallons. This volume was determined by observing the amount of liquid removed when the transition at the saltcake surface was reached (see discussion in Section 7 below).

The initial pump flowrates ranged from 5-20 gpm. The well level was lowered to approximately 120 inches initially (see Figure 1). The interstitial liquid pump began to experience problems following the first pump down. The well level recharged to approximately 230 inches before the pump was restarted several days later. The following transfer reduced the well level to approximately 120 inches before the pump tripped off. At this point numerous attempts were made to restart the pump and sustain a transfer, however, issues with the pump continued and it was determined that the pump was not operating properly and needed to be replaced.

With the second pump installed, interstitial liquid draining resumed on December 28, 2006. One day later, the flow totalizer encountered problems which required the flow indicator to be replaced. The replacement occurred on January 4, 2007. Transferring and draining resumed over the next couple of weeks and the well level was reduced to approximately 45 inches. During this period the transfer was stopped and started a number of times due to weather impacts and to perform other F-Tank Farm operations which impacted the Tank 25 to Tank 34 transfer. On January 22, 2007, the transfer was terminated to allow the facility to enter a planned outage.

Following a two-week downtime for the planned outage, draining was resumed. The well level had recharged to approximately 75 inches during the two-week period. Prior to this time, the liquid level in the salt well had not been pulled down to the pump suction level. The lowest recorded well level prior to the planned outage was approximately 45 inches. The final stages of the interstitial liquid draining removed liquid until the level within the well reached the pump suction and caused the pump to trip due to low or no flow. The well was then allowed to refill and the pump was restarted to drain the well again. The lowest recorded well level during this phase was 24 inches. This process was repeated five times prior to concluding interstitial liquid draining.

Four additional interstitial liquid transfers, using the same pumping system, have been performed in the 11 months since the completion of the deliquification process. After approximately 1,300 hours of drain time the pump was started on April 18, 2007 and pumped out 2,800 net gallons. Prior to the next transfer on June 18, 2007, the well drain time was 1,500 hours and resulted in a net gallons removed of 13,000. After these two transfers, two additional transfers were performed on August 8, 2007 and October 6, 2007 after drain times of 1,100 and 1,400 hours respectfully resulting in a net removed of 100 gallons each.

6 Discussion

A total of approximately 286,000 gallons were transferred from Tank 25 to Tank 34 during the deliquification process. The following is a breakdown of the volume as of October 6, 2007. Additional flushwater continues to be added to unplug the caisson level dip tubes to obtain periodic well levels.

Supernate removed with jet:	~128,000 gal
Supernate removed with ID pump:	~ 5,000 gal
Flush water additions to Tank 25:	~ 28,000 gal
Interstitial liquid:	~102,000 gal
Additional interstitial liquid:	~ 16,000 gal
Additional flush water	~ 7,000 gal
Total liquid transferred	~286,000 gal
Total interstitial liquid:	~118,000 gal
Total supernate and interstitial liquid transferred	~251,000 gal

The volume of supernate removed with the jet was based on the morning reports from March 15 and 18, 2005. The supernate removed with the interstitial liquid pump was

estimated from the remaining volume and the point in which the saltcake began to be exposed. The point in which salt was exposed was determined by comparing the volume of liquid transferred to the decrease in level height. The saltcake level was estimated to be 316 inches[5] prior to interstitial liquid draining. During draining, the amount of liquid transferred and liquid level were tracked and compared in the region of the saltcake surface. A decrease in the amount of liquid removed per tank depth was observed when approximately 5000 gallons of material was removed. This signifies the transition from the free liquid/supernate region to the saltcake region. This occurred between levels of 315 and 319 inches. The saltcake surface within the tank is not perfectly flat and this value is considered a best estimate for the amount of supernate removed. A salt sounding was performed after draining and the saltcake level was measured at 313 inches[7].

Comparing the results of the deliquification process in Tank 25 with the flowsheet assumptions[5] shows the actual volumes for both supernate and interstitial liquid removal to be below the nominal values assumed. The nominal values were based on experience obtained during the Tank 41 salt dissolution campaign.

The majority of the difference between the projected, 161 kgal, and actual, 133 kgal, supernate volumes can be attributed to the liquid level differences as measured by the reel tape. The early projections assumed an initial liquid level of 362 inches. As previously discussed, the tank level reading at the initiation of supernate removal was measured to be approximately 359 inches. In addition, the standardization of the reel tape just prior to interstitial removal accounts for a difference in tank level of approximately 4.7 inches. These two items account for a volume difference of approximately 26 kgal. The remaining difference between the projected and actual supernate volumes can be attributed to irregularities in the saltcake surface that make it hard to estimate the effective average salt level. The salt level has been estimated at 313 inches by salt sounding, 316 inches from the flowsheet, and between 315-319 inches from draining data. As discussed above, the 5000 gallons of supernate removed by the interstitial liquid pump is a best estimate based on the drain data.

The final stage of interstitial liquid removal involved pumping out liquid until the pump failed to run due to low or no liquid available. A small amount of water was added to flush the pump and transfer lines to avoid pluggage caused by salt buildup. This process was repeated until the amount of liquid removed was approximately equal to or less than the amount of flush water added. In other words, the net amount of liquid removed from the tank equaled zero. At this point the interstitial liquid draining was stopped.

The amount of interstitial liquid removed fell within the estimated range of 75 kgal to 230 kgal. While within the range, the amount differed slightly from the nominal value. This difference can be explained several ways; a smaller void fraction, smaller interstitial liquid fraction and smaller drainable fraction are a few examples. Although, without sample data from an undisturbed saltcake sample, a definitive reason cannot be determined.

Figure 2 shows the amount of liquid drained over time. The front part of the curve is the time period where liquid was readily available to be removed. During this time, the transfer stoppages were due to mechanical and schedule needs. Conversely, there came a point in which a well refill was required to provide liquid to be transferred. From this

point, a small volume is gained over a comparatively long period of time. Significant liquid removal cannot be expected from this point forward.

The final interstitial remove pump downs can be seen at the end of Figure 1. Each of these pump downs reduced the well level to less than 30 inches. Once the pump was stopped, the well level increased significantly (greater than 20 inches) in a short period of time (a few hours) due to drain back of the transfer fluid and due to the addition of flush water resulting from transfer line flushes that are required to prevent salt formation in the transfer lines. Once this initial refill (to approximately 60 inches) occurred, well level increase due to infiltration of interstitial liquid was minimal. At this stage in the interstitial draining process, the well level only increased ~ 1 inch per week, with a significant portion of that increase due to periodic level dip-tube and pump flushes. This illustrates the minimal volume of interstitial liquid moving to the well at a level above ~60 inches.

After approximately 1,300 hour of well recovery time after completion of the deliquification process the well recovered to approximately 77 inches prior to the April 18 transfer. The well level during the four transfers varied between approximately the 30 and 50 inch level. The well level for the four transfers during pumping and well recovery is shown in Figure 3. The well recovery time between transfers was significant, over 1,000 hours, to allow the slow draining liquid to drain into the well. Figure 4 shows the amount of liquid drained over time including the four additional transfers. The last two transfers resulted in a net interstitial liquid removed of approximately 100 gallons each. The forth transfer was performed on October 6, 2007. The well recovery time has been 2,200 hours since completion of the forth transfer up to January 6, 2008, approximately 1,700 gallons of flush water has been added, and the well has recovered to approximately 77 inches. This is the same level that the well recovered to after deliquification completion and prior to the first transfers indicating little additional interstitial liquid was removed.

7 Conclusion

Interstitial liquid removal operations in Tank 25 have reached a point where the liquid level in the well is being pumped down to the minimum level possible and there is no longer appreciable flow of interstitial liquid into the salt well. The volume of liquid that can be removed by running the pump is essentially equal to the volume of flushwater that must be added to sustain operations. Tank 25 interstitial liquid removal has reached a practical limit where continued attempts to remove material will result in a limited amount of additional interstitial liquid being removed while continuing to add flushwater into the Liquid Waste System. Deliquification of Tank 25 has reached the point where interstitial liquid has been removed to the maximum extent practical when considering the significant quantities of additional flush water added to the system with negligible additional interstitial removed and, therefore, salt dissolution activities in Tank 25 should not be delayed for the purpose of removing additional interstitial liquid. Over long periods of time, additional interstitial liquid may continue to drain into the salt well, however, the volume of material is expected to be small and the amount that will be able to be removed will be limited. If salt dissolution activities in Tank 25 are delayed for

other reasons, the liquid level in the tank will be monitored and attempts to remove additional interstitial liquid may be performed at thirty to forty-five day intervals if interstitial draining equipment remains operable and transfers can be sustained.

Salt dissolution in Tank 25 has been delayed since completion of deliquification. Four additional interstitial liquid removal transfers have been completed since the completion of deliquification. The last two transfers resulted in 100 gallons of interstitial liquid removed each. The starting and ending well level remained unchanged for these interstitial liquid removal transfers indicating little additional interstitial liquid was removed.

To achieve planned salt processing objectives, initiation of bulk salt dissolution activities on Tank 25 are underway. Therefore, additional interstitial liquid removal transfers will not be performed. Initial activities include completion of the FDB-2 transfer facility upgrades (supporting salt transfer capabilities), removal of the Tank 25 interstitial liquid removal pump, installation of the salt solution pump, and initiation of the Tank 25 Salt Dissolution Management Checklist.

Based on current plans, the salt solution resulting from dissolution of Tank 25 saltcake will be treated through the Actinide Removal Process (ARP) and Modular Caustic Side Solvent Extraction (CSSX) Unit (MCU) prior to being solidified into a grout matrix and disposed in the Saltstone Disposal Facility (SDF) vaults.

8 References

[1] Basis for Section 3116 Determination for Salt Waste Disposal at the Savannah River Site, DOE-WD-2005-001, Rev. 0, January 2006

[2] d'Entremont, Paul, Mark Mahoney, Jason Vitali and David Chew, FY06-FY12 Liquid Waste Disposition Processing Plan (DPP), CBU-PIT-2006-00070, Rev. 0, May 2006

[3] Westinghouse Savannah River Company, Response To Additional Information Request on Draft Section 3116 Determination For Salt Waste Disposal at Savannah River Site, CBU-PIT-2005-00131, Rev. 1, July 14, 2005

[4] Hester, J. R., High Level Waste Characterization System (WCS), WSRC-TR-96-0264, February 1997

[5] Pike, Jeff, Flowsheet and Physical Property Estimation for SRS Tank 25 Salt Dissolution, CBU-PIT-2005-00081, Rev. 0, May 2005

[6] http://vista/lwdp/index.asp, Morning report

[7] Transfer Jet/Pump/Waste Downcomer Levels and Adjustments Data Sheet, SW11.1-WTE, Section 7.2, Rev. 22, IPC-5, February, 2007

Table 2 - Tank 25 Interstitial Liquid Draining Timeline

Date	Activity
3/16/2005	Supernate transfer to Tank 34
3/17/2005	Supernate transfer to Tank 34
4/21/2005	Began caisson installation
4/25/2005	Completed caisson installation
9/14/2006	Installed pump
10/23/2006	Started pumping
11/4/2006	First pump failed to start
11/23/2006	Path forward issued to replace first pump
12/13/2006	First pump removed
12/19/2006	Installed second pump
12/28/2006	Transfers resumed
12/29/2006	Flow totalizer screen blanked out
1/4/2007	Flow display replaced and data chip swapped from first display
1/4/2007	Transfers resume
2/22/2007	Interstitial liquid draining complete
4/18/2007	First additional transfer
6/18/2007	Second additional transfer
8/8/2007	Third additional transfer
10/6/2007	Forth additional transfer

Figure 1 – Interstitial Liquid Draining Well Level

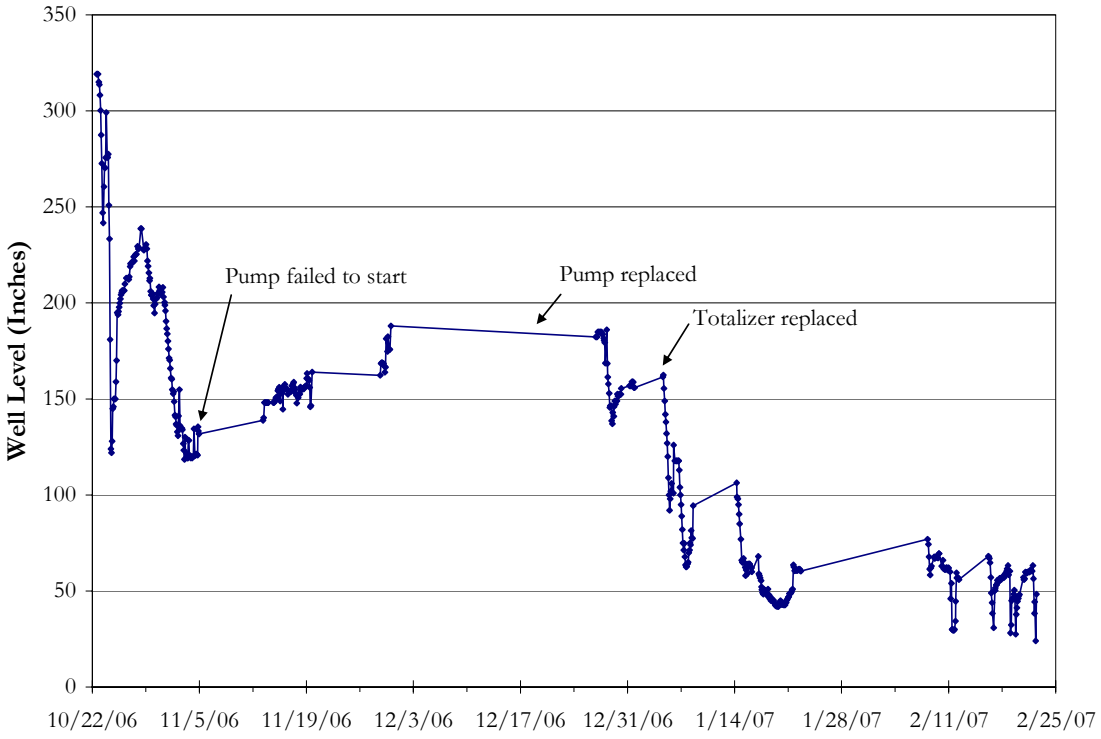

Figure 2 – Interstitial Liquid Removal Completion

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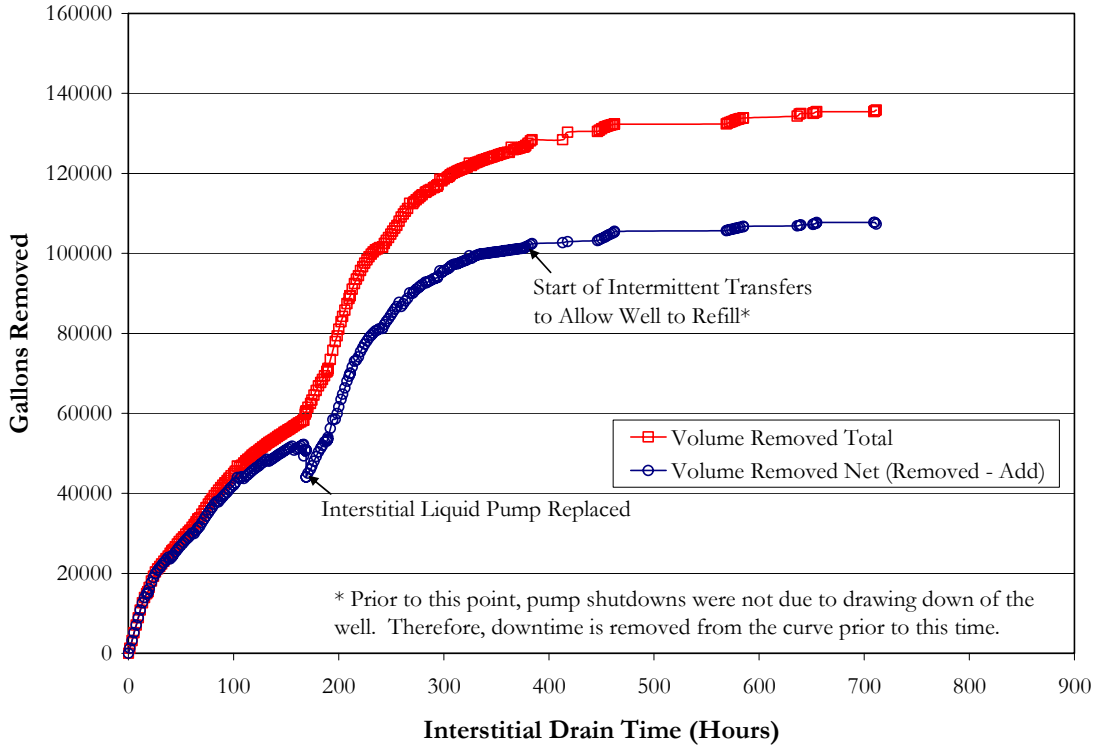


Graph includes 5,000 gallons of free supernate

Figure 3 - Interstitial Liquid Draining Well Level Additional Transfers

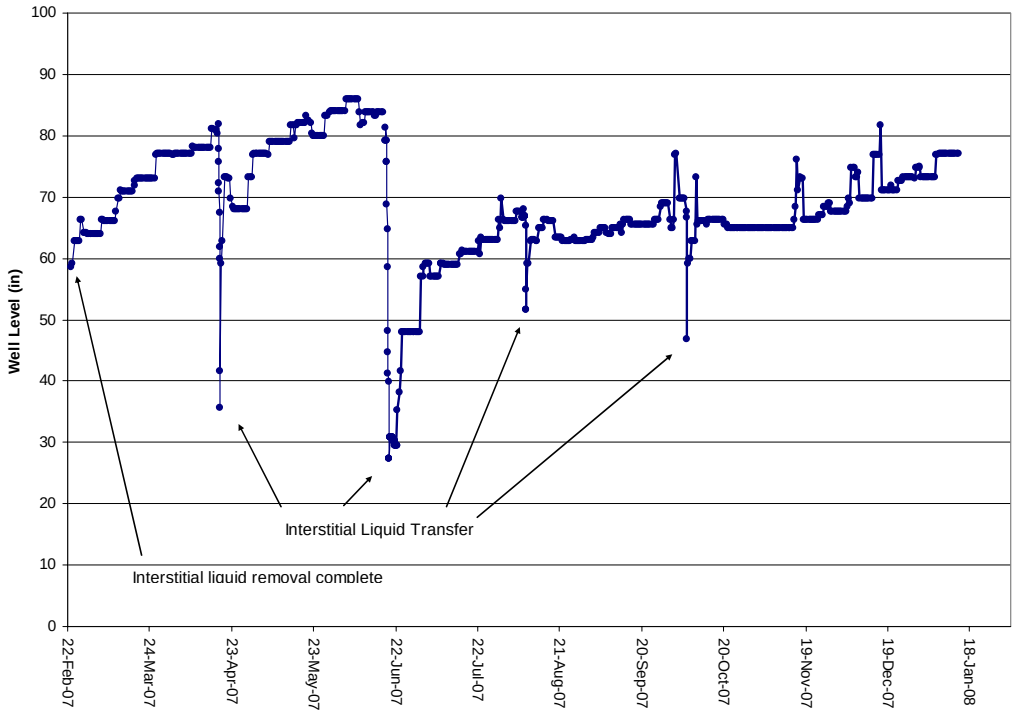
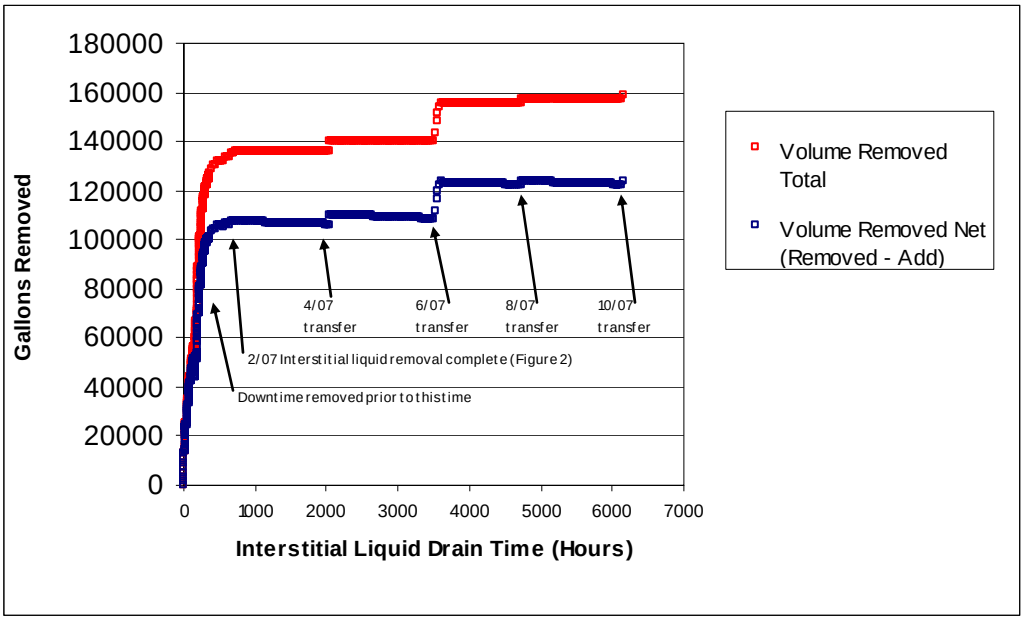


Figure 4 - Interstitial Liquid Removal Long Term



Graph includes 5,000 gallons of free supernate