Tank 25F History

From 1980 to 2004

Liquid Waste Disposition Projects

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Summary of Revisions

04/04	Revision 0; Initial Issue

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Section 1

General Information

SUMMARY

Tank 25 is a type IIIA tank, located in F Tank farm, 85 feet in diameter and 33 feet tall, with a fill factor of 3510 gallon/in. Appendixes A, and D, respectively, give the tank general location and composite tank level schematic information. The tank was placed in service in 1980 as a drop tank for the 242-1F evaporator until 1988. Waste from the F-Canyon was sent to the F tank farm and the 1-F evaporator was used to further concentrate the waste. The relevant feed tanks to the evaporator are Tank 7 (1977-1983) and Tank 26 (1985-1988). Tank 25 transferred supernatant liquid out only to Tank 26 for the period 1981-1991 and the tank has been inactive since that time. For the entire year of 1984, there were no transfers to/from the 1F evaporator. Tank 25, with a salt level at 113", was idle for this period (10/1983 to 3/1985). Based on this, along with the recent Tank 25 Annulus Gamma Monitor (AGM) result[5], some physical variations at this salt stratum are expected. There is no leakage of the tank wall or cooling coils.

The High Liquid Level Conductivity Probe (HLLCP) is set at 368 inches and the current liquid level in the tank is 363.5 inches (2/2004) with a salt level of 313 inches. The tank content average temperature is 30^{o}C [1]. The Cesium content of the latest corrosion dip sample taken on 4/10/1997 for which cesium data is available was 4.4 Ci/gal[2]. The tank AGM result shows its saltcake has a vertical gamma profile at 1.5 Ci/gal of salt cake. This corresponds to a liquid void fraction of about 30%.

TANK CONFIGURATION

Figure 6 from **Appendix A** provides a general overview of all of the tank risers. System design description document (G-SYD-F-0001)[3] gives more descriptive information for all risers of the tank. The following risers are considered significant to the waste characterization and processing of the tank:

<u>Riser B1</u> provides access for the out-of-service Cesium Removal column (CRC) which was used to remove cesium from the 1F evaporator condensate.

Risers B2 and B5 have four spare plugs; they can be good access ports for collecting core or liquid samples. However, space requirement for the current Ramset sampler limits its use to the B2 riser for collection of core samples.

Riser C1 is the gateway for entering fresh waste or discharged salt solution during the waste removal process. A steam driven transfer jet is also located under this riser, along with inhibited water spray ring. A downcomer is located in this riser.

Riser C2 allows the CTS-concentrate loop line to enter and exit the tank.

Riser C3 is the gravity drain line for waste concentrate from 2F evaporator entering the tank.

Riser F provides access for the annulus transfer jet (WTE-P-4). It also contains one spare plug.

E1 and G risers contain two spare plugs. The G riser is also the access port for manual liquid steel tape measurement.

B3, B4, and H risers have inhibited water spray manifolds mounted above, which were installed to decontaminate slurry pumps which were expected to be installed for salt removal.

Section 2

Tank Fill History

TANK TO TANK TRANSFERS

Waste stream from F-Canyon[10] was transferred to the relevant Tanks (7, 8, 17, 18, 19, 26, and 47) at various time frames. Specifically, Tanks 7, 17, and 26 were the major F-canyon waste recipients. Tank 8 which received both HHW and LHW from the F-Canyon; the other tanks received only LHW. Nevertheless, the HHW was transferred to Tank 8 during the period of 1960-1974 which is outside the interested time frame for Tank 25 waste material. The only relevant transfer from Tank 8 to Tank 7 was the fresh low heat waste supernate transfer in 1980-1981. Tank 17 also received a large quantity of heel water (127,400 gallons) along with non-canyon waste (possible sludge presence) from the 100 Area Trailer during 1961-1992. **Figure 1** shows major inter-tank-transfers that are relevant to Tank 25 content.

During the period of 1960-1976, Tank 18 fed the 242-1F evaporator whose bottom products were sent to three Tanks: 17, 19, and 20. The decanted supernate from these three drop tanks was transferred to the Tank 18 to further concentrate the waste (**Figure 10**).

Salt dissolution was done on Tank 17 (1980-1985), Tank 19 (1980-1981), Tank 20 (1980, 81, 86) and the waste material was sent to Tank 18. Even though Tank 17 contains sludge, salt removal waste process left the majority of the sludge in the tank. Waste material sent to Tank 18 was mainly composed of dissolved salt solution. Subsequently, Tank 18 (1980-1986) sent the dissolved salt solution to Tanks 7 and 26 (**Figures 8, 9**) which served as the feed tanks for the 1F evaporator (1977-1988). Tank 26 also fed the 2F evaporator starting in 1979; the recipient tanks for the 2F-evaporator are 27, 28, 44, 45, 46, and 47. These six tanks in turn completed the 2F concentration loop by feeding to Tank 26.

Tank 25 (**Figure 7**) received concentrated waste (1980-1988) from the 1F evaporator which was fed by Tank 7 (1977-1983) and Tank 26 (1985-1988). The liquid waste of Tank 25 was made more concentrated by recycling waste to Tank 26 to be fed back to the evaporator. Tank-25 contents are generally considered homogeneous due to receiving mostly F-Canyon fresh waste and only 9,000 gallons of evaporator flush water and CTS-condensation.

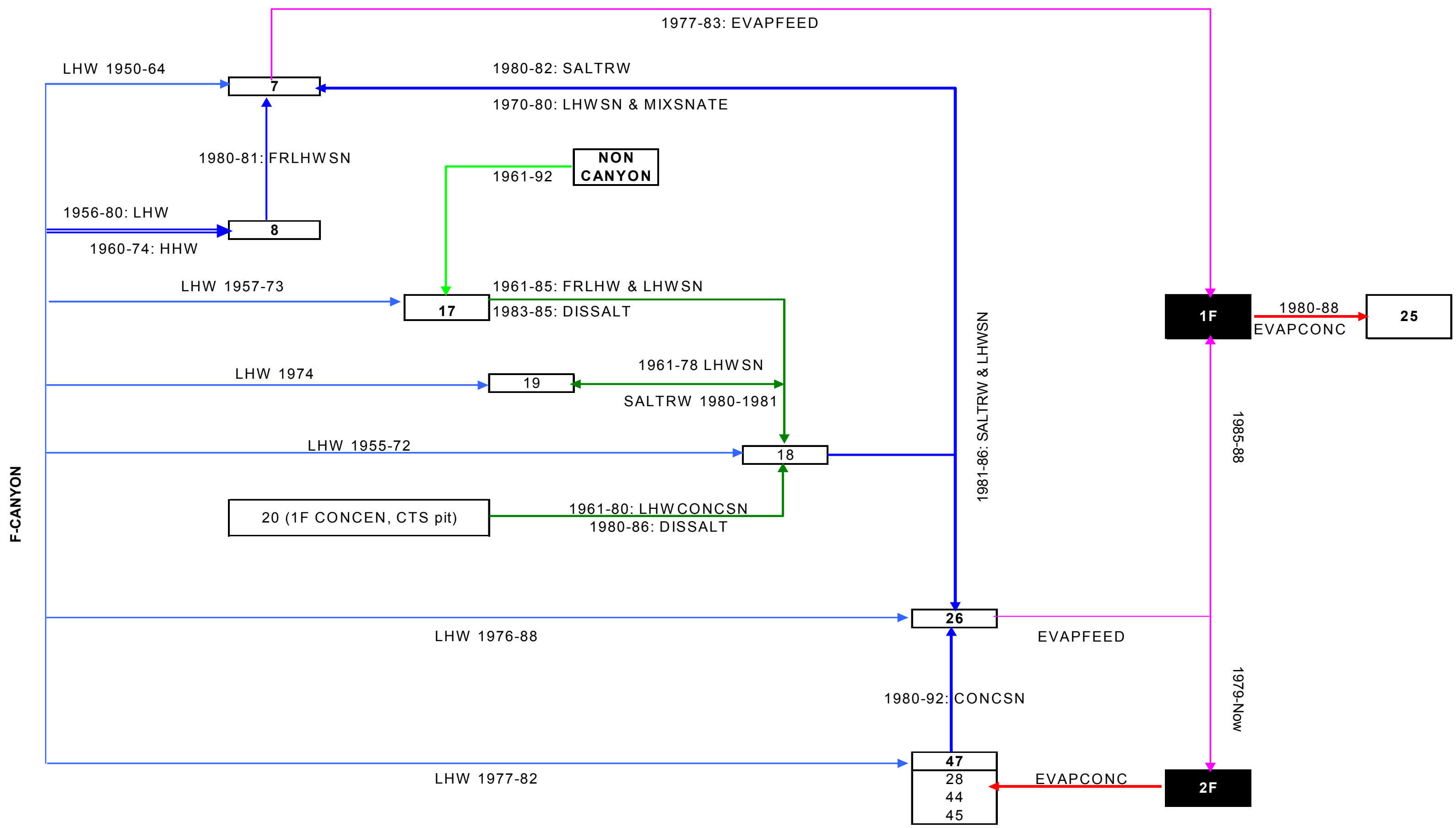


Figure 1: Major Intertank Transfers

Where: LHW: low heat waste; HHW: high heat waste; FRLHWSN: fresh low heat waste supernate; EVAPFEED: evaporator feed; SALTRW: salt removal waste; LHWSN: low heat waste supernate; MIXSNATE: mixed supernate; DISSALT: dissolved salt; LHWCONCSN: low heat waste concentrated supernate; CONCSN: concentrated supernate; EVAPCONC: evaporator concentrate

When the tank receives hot concentrated solution from the evaporator, solid salt precipitates out of the liquid and settles as the temperature cools down. As the cycle of salt solidification and supernate re-concentration proceed, salt level in the tank increased (**Figure 2**). From this figure, physical variations at 113" salt strata are expected due to no evaporator concentrate being transferred into the tank during the 10/1983 to 3/1985 timeframe. This hypothesis is supported by a recent Annulus Gamma Scan profile[5] which indicates a possibility of high porous saltcake stratum just above this level. (**Appendix C, Figure 13**).

From the saltcake level profile, there are sporadic decreases in saltcake levels even though there was no salt removal activity. Data for saltcake and supernate levels are obtained from the saltcake volume and the total volume including supernate in the tank; therefore, a direct correlation between the supernate and the saltcake levels exits. Since the two volumes reported in the monthly reports are done by irregular intervals from soundings, visual inspection, and/or pump down data; volumes quoted are for qualitative estimate only, not necessarily quantitative.

The Cesium Removal Column (CRC) for the 1F-evaporator was relocated from Tank 19 to Tank 25 in February 1985 and 1,050 gallons of zeolite (1985-1988) from the CRC was introduced into the tank until the CRC was removed from service in 1988.

The level database[6] shows sludge presence for the month April, 1980 and the period June to December, 1985; however, monthly reports[7] indicate the tank only contains salt and supernate. Therefore, the salt and supernate levels are corrected for these periods.

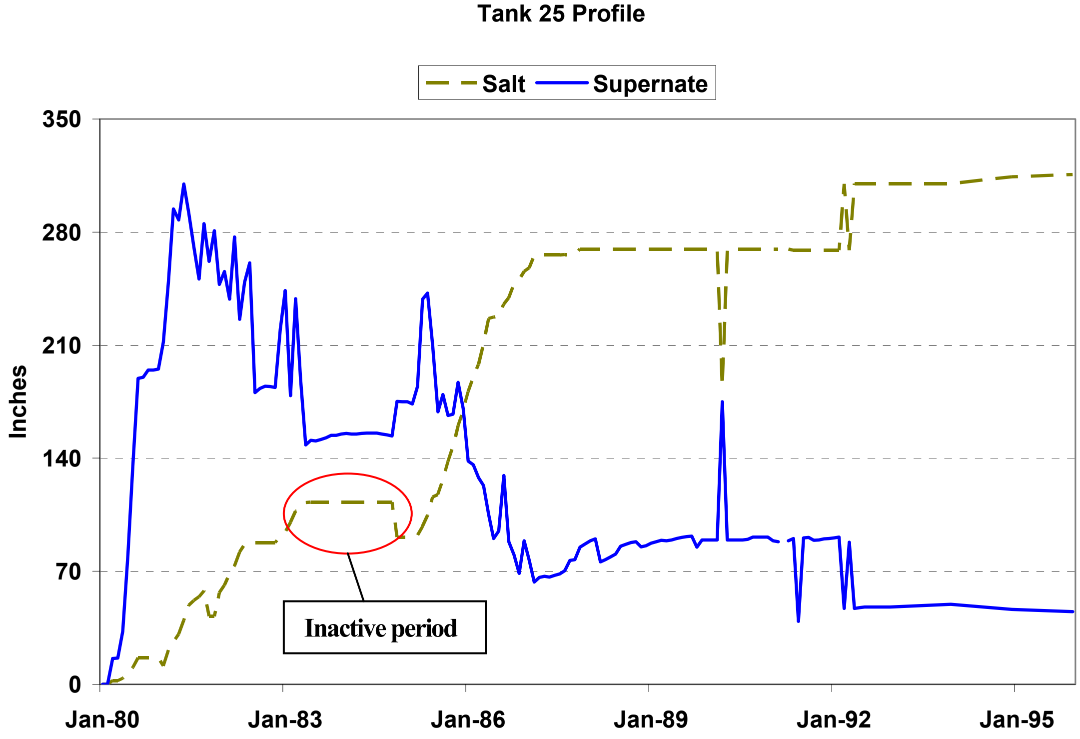


Figure 2: Tank 25 salt and supernatant liquid Levels
The supernate level is the level above the saltcake level.

OTHER TRANSFERS

There were three additions (1981, 1982, and 1983) into Tank 25 totaling 9,000 gallons of evaporator flush water and CTS condensate. Since both the amount and the radioactivity are small, these additions are not likely to cause any changes to the Tank 25 bulk waste content.

COOLING COIL LEAKS

There are no known cooling water leaks.

Section 3

Sample History

DIP SAMPLES

Corrosion Control Samples

Dip samples[2] have been taken annually ever since the tank was put into service. The supernate cesium profile over time (**Figure 3)** indicates low concentrations (~1 Ci/gal of supernate) for the period 1985-1988 and ~ 5 times greater than that for the period of 1992-1997. There are reasonable explanations to this discrepancy in the cesium data. First, samples taken for the period 4/1985-4/1988 have Nitrite, Nitrate, and/or Hydroxide values that vary significantly compared to their normal ranges. **Table 1** presents Tank 25 supernate samples data in chronological order from 1980 to 2002 and the discrepancies in some species are highlighted. Second, it is known that gross gamma relates directly to cesium in the supernate phase, however, **Figure 3** shows that the gross gamma profile (average 4.6 Ci/gal) is more consistent than the cesium profile. The Tank 25 AGM result indicates a vertical cesium profile of about 1.5 Ci/gal of salt cake which is equivalent to approximate 4.5 Ci/gal of supernate with an assumed of 30% liquid volume in the saltcake. Third, the 1F-Evaporator overheads (assuming a very high cesium content of 2000 d/m/ml) ran through the CRC column and discharged at 200 d/m/ml to the F-area seepage basin; the 1,050 gallons of zeolite correlates to a total of 3,600,000 gallons overhead would give a 12.4 Ci maximum activity. Thus, the zeolite degeneration[9] in the Tank 25 contributes an insignificant amount of cesium to the supernate. Furthermore, after 1988 no noticeable high radioactive waste was transferred into the tank to potentially alter its supernate cesium concentration. Therefore, the cesium contents at 1 Ci/gal for the period of 1985-1988 are not representative data of the tank supernate.

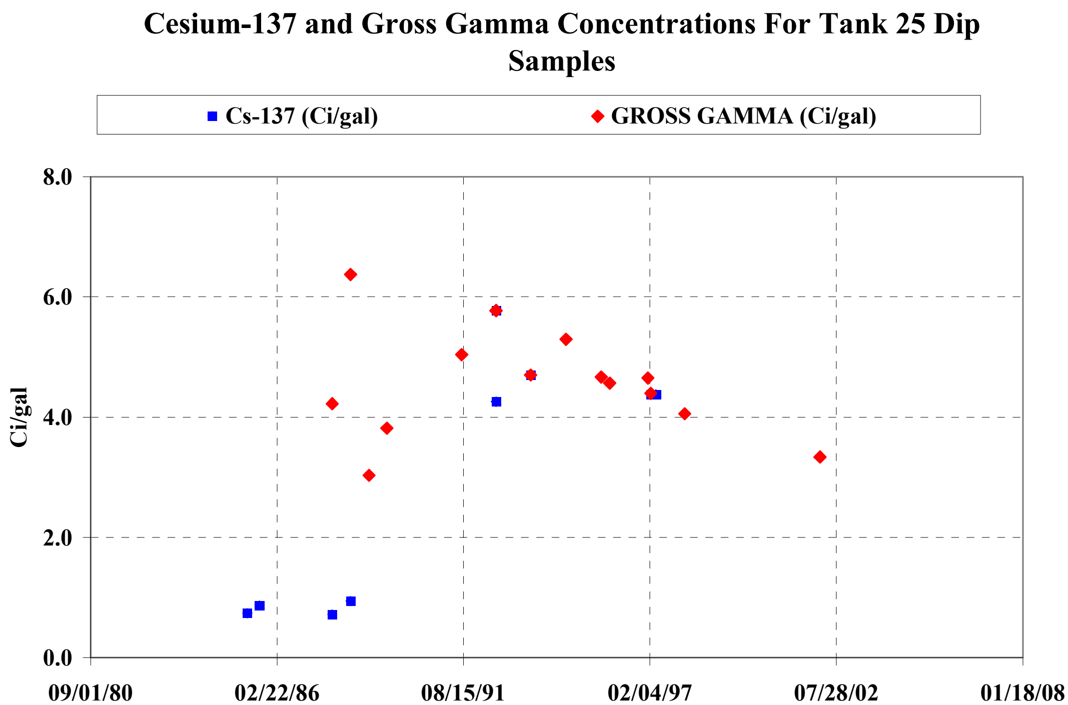


Figure 3: Tank 25 Supernate Cesium-137 and Gross Gamma Concentrations Profiles

Table 1: Tank 25 Dip Samples Profile With Highlighted Data in Questions

		IONIC CONCENTRATION					Radiolytic activity		
Sample Date	**pH**	**NO2 (M)**	**NO3 (M)**	**OH (M)**	**PO4 (M)**	**SO4 (M)**	**ALPHA (Ci/gal)**	**GROSS GAMMA (Ci/gal)**	**Cs-137 (Ci/gal)**
02/04/02	14.86	1.1642	1.3646	8.3100	0.0167	0.0056		3.34E+00	
02/12/98	14.82	1.3000	1.3400	9.2200	0.0180	0.0050		4.05E+00	
04/10/97		1.2900	1.4600	8.8700	<0.1070	<0.1060	1.09E-02		4.38E+00
02/13/97		1.2900	1.4600	8.8700	<0.1070	<0.1060	1.09E-02	4.39E+00	4.38E+00
01/13/97	14.72	1.3100	1.3200	9.5000	0.0200	0.0056		4.65E+00	
12/01/95	14.45	1.4300	1.9000	10.4900	0.0200	0.0061		4.57E+00	
11/30/95		1.2600	1.3700	7.8100			5.31E-04		
08/31/95	14.78	1.3200	1.8500	9.4600	0.0180	0.0054		4.67E+00	
08/18/94	14.15	1.2800	1.8800	9.2500	0.0220	<0.010		5.30E+00	
08/05/93	14.05	1.5500	2.3900	10.8400	0.0200	<0.0082		4.70E+00	4.70E+00
07/30/92	14.27	1.2600	1.9300	10.6600	0.0140	0.0053	8.52E-03	5.77E+00	4.26E+00
07/30/92	14.27	1.2600	1.9300	10.6600				5.77E+00	5.77E+00
07/30/92		1.3000	1.3400	10.6000	0.0140	0.0053	8.52E-03		4.26E+00
07/26/91	14.00	1.3200	1.9100	9.7400				5.04E+00	
05/15/89	13.90	1.3600	1.6900	7.1500				3.82E+00	
11/04/88	14.20	1.3600	2.3500	5.1600				3.03E+00	
04/21/88	14.48	7.9800	1.5600	11.1920				6.37E+00	9.40E-01
10/07/87	13.71	0.0240	0.0260	7.1000				4.22E+00	7.21E-01
04/04/86		1.4900	1.7600	8.4000					
08/19/85	13.20	1.4500	2.7200	4.3800					8.69E-01
04/09/85									7.41E-01
03/19/85	13.67	1.0400	2.4800	2.8500					
02/09/84	14.34	1.2500	3.0500	6.9200					
03/18/83	14.20	0.8500	3.6200	6.0000					
06/30/82	14.40	1.3000	2.8000	7.6000					
11/10/81	14.00	0.8000	3.2000	4.4000					
11/06/81	13.40	1.2000	3.1000	7.1000					
10/16/81	14.50	0.2000	5.6000	0.6000					
04/08/81	14.20	0.9000	2.9000	5.2000					
09/22/80	11.40	1.3000	1.9000	7.2000					

Other Samples

N/A

Criticality Samples

N/A

Saltcake Core Samples

N/A

Interstitial Liquid Samples

N/A

Section 4

Process History

TEMPERATURE

The following curves depict Tank 25 content temperature profile over time. Overall, the supernate temperature averages around 40 °C while the salt mean temperature increased from 42 °C to 48 °C as the salt built-up. Tank temperature database[6] contains sludge temperatures for the periods 7/1985-12/1985 and 11/1990-8/1992; however, monthly reports indicate no sludge presence. The data presented here, **Figure 4,** are corrected for the affected periods:

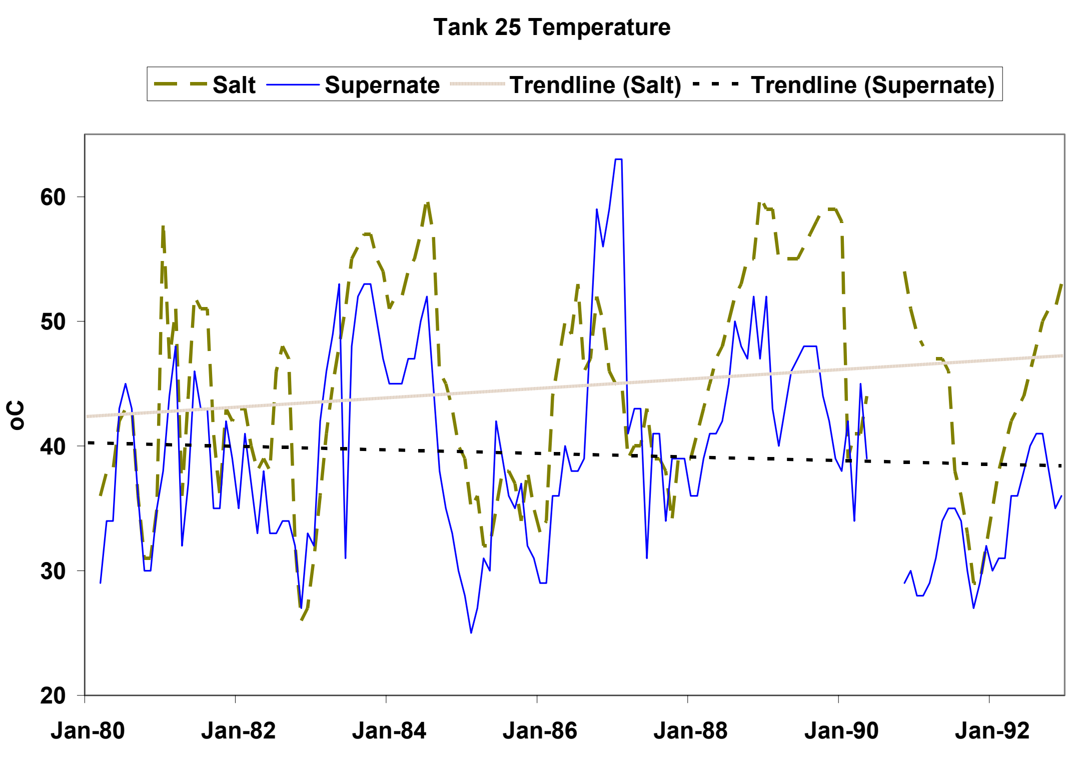


Figure 4: Tank 25 supernate and salt temperature profile

For further details on separate supernate and salt profiles of the Tank 25, **Figures 10** and **11** from **Appendix C** sketch the data up to 1995.

CAMERA INSPECTIONS

The latest video inspections[11] performed on the tank indicated a thin crust formed at the liquid surface and the tank annulus is clean. Snapshots of the tank interior (2002-2003) and annulus (2004) are shown in **Appendix E**.

SPECIAL STUDIES

A study (HLW-HLE-96-0191) of the Tank 25 transfer jet flow rate was done in 6/1996 and the flow rate was determined to be acceptable for a Tank 25 to Tank 48 transfer. [8]

OTHER

None

Section 5

Conclusions

Tank 25 saltcake is considered relatively homogeneous since it received mostly LHW from F-Canyon. There are no annulus contaminations, cooling coils or tank wall leaks. The CRC installed in B1 riser is not in service. Zeolite from the CRC was pumped into the tank contributed an insignificant quantity to the tank cesium content. There are plenty of access ports into the tank interior to retrieve core and liquid samples. Saltcake at 113" stratum physical properties are expected to be different. The saltcake has a relative uniform cesium content of approximately 1.5 Ci/gal of salt cake based on the Tank 25 AGM result. Salt temperature increased as more salt is accumulated inside the tank.

Section

6

References

1 WG15:\\Waste Characterization System\WCS1.5PROD/WCS1.5
2 WG17:\\HLW Tank Chemistry\NTANK25
3 "Tank 25 WTE & HV Systems- System Design Description", G-SYD-F-00001, Rev. 1, May 24, 1995.
4 "Waste Transfer and Miscellaneous Additions", WSRC-TR-93-425, Rev. 0, August 9, 1993.
5 Tank 25 Annulus Gamma Monitor (AGM) Measurements Report, CBU-SPT-2004-00058, Rev, 0, March 22, 2004.
6 WG08:\\Level and Temperature Database
7 "Waste Management Programs Report", DPSP-(Last two digit of the year)-21-(Month), January 1980 – December 1992.
8 "Tank 25 To FPT-1 Transfer Results", HLW-HLE-96-0191, Rev. 0, June 10, 1996.
9 "Determination of Tank 19 Zeolite Samples Dose Rates", S-CLC-F-00416, Rev. 0, September 24, 2001.
10 "Fresh Waste Receipts", WSRC-TR-93-426, Rev, 1. January 21, 1994.
11 "Annual Radioactive Waste Tank Inspection Program", (1991) WSRC-TR-92-166, Rev. 1, (1993) WSRC-TR-94-166, (1995) WSRC-TR-96-0166, (1996) WSRC-TR-97-0054, (1997) WSRC-TR-98-0083, (1998) WSRC-TR-99-00069, (1999) WSRC-TR-2000-00067, (2002) WSRC-TR-2003-00175.
12 "Tank History Project: History of The High Level Liquid Waste Tanks at SRS", WER-HLE-921383, December 17, 1992.

Section

A

Appendix A – Tank 25 Location and Risers Layouts

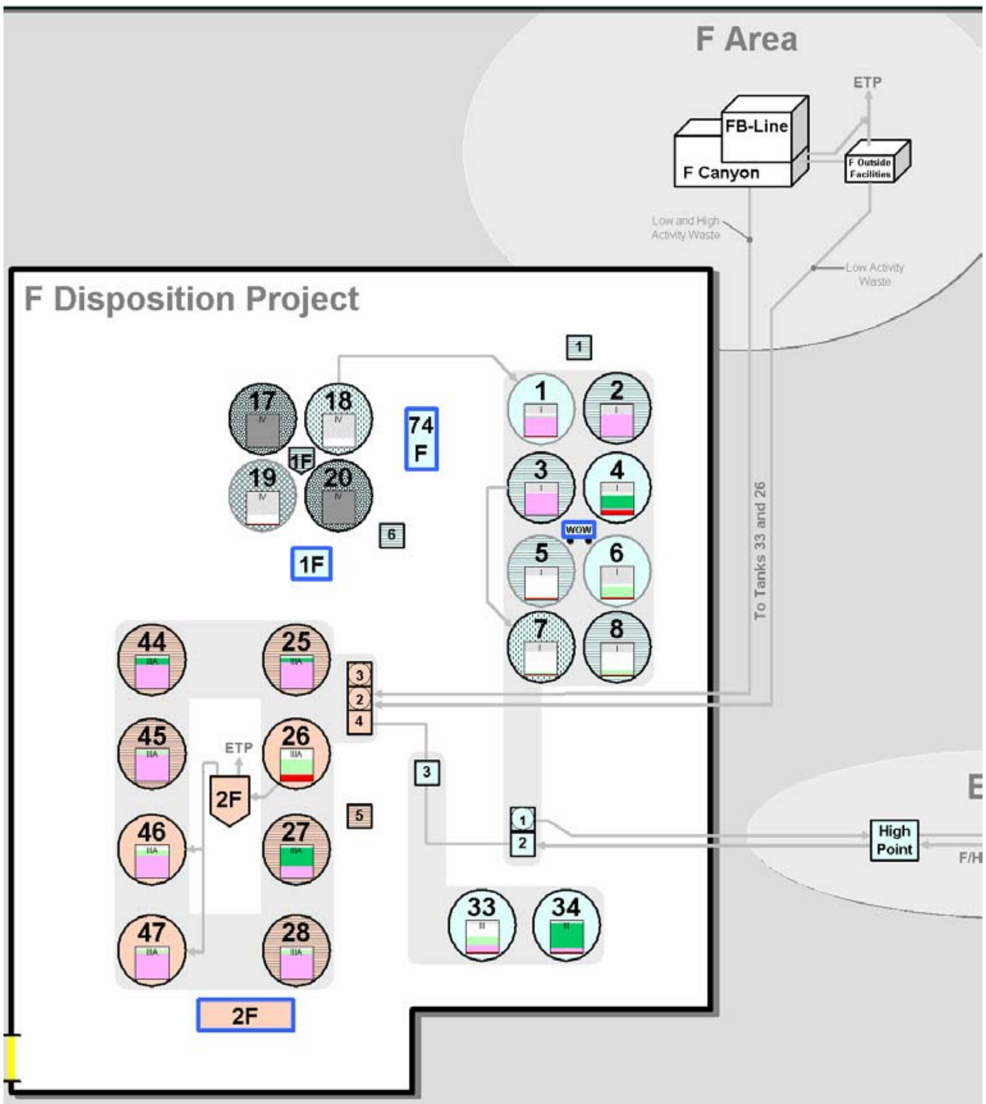
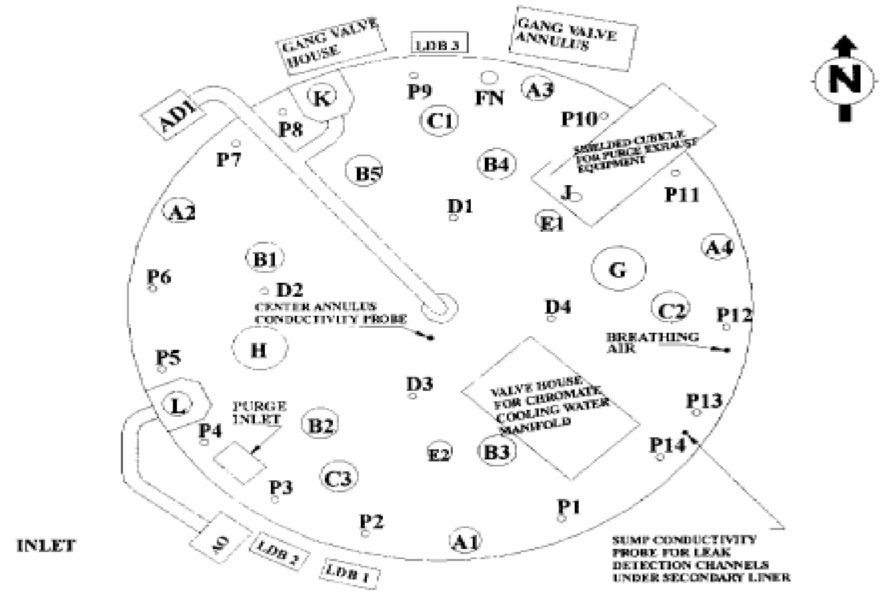


Figure 5: Tank 25 Location in F Tank Farm



RISER NUMBER	DESCRIPTION
A1	BUBBLER DIP TUBES, SPARE PLUG
A2	CONDUCTIVITY PROBE, SPARE PLUG
A3	CONDUCTIVITY PROBE, SPARE PLUG
B1	CESIUM REMOVAL COLUMN (NO LONGER IN SERVICE)
B2	FOUR SPARE PLUGS
B3	INHIBITED WATER SPRAY MANIFOLD (FOR FUTURE SLURRY PUMP INSTALLATION)
B4	INHIBITED WATER SPRAY MANIFOLD (FOR FUTURE SLURRY PUMP INSTALLATION)
B5	FOUR SPARE PLUGS
C1	INLET FROM FDB 4 AND PRIMARY TANK TRANSFER JET
C2	CONCENTRATE TRANSFER SYTEM DRAWOFF VALVE
C3	GRAVITY DRAIN LINE FROM EVAPORATOR 242-16F
D1	THERMOCOUPLE WELL, STAND PIPE
D2	THERMOCOUPLE WELL, STAND PIPE
D3	THERMOCOUPLE WELL, STAND PIPE
D4	THERMOCOUPLE WELL, HYDROGEN MONITOR SAMPLE INLET
E1	TWO SPARE PLUGS
E2	REEL TAPE CONDUCTIVITY PROBE, HIGH LIQUID LEVEL CONDUCTIVITY PROBE
F	ONE SPARE PLUG, ANNULUS TRANSFER JET
G	INHIBITED WATER LINE, TWO SPARE PLUGS
H	INHIBITED WATER SPRAY MANIFOLD (FOR FUTURE SLURRY PUMP INSTALLATION)
J	DEMISTER (PURGE AIR OUTLET)
K	ANNULUS AIR INLET
L	ANNULUS AIR OUTLET
P1 - P14	ANNULUS INSPECTION PORTS
AO	ANNULUS AIR OUTLET FAN PAD
ADI	ANNULUS DEHUMIDIFIER INLET

Figure 6: Tank 25 Risers Arrangement (G-SYD-F-00001)

Section B

Appendix B –Tank 25 Transfer History Diagram

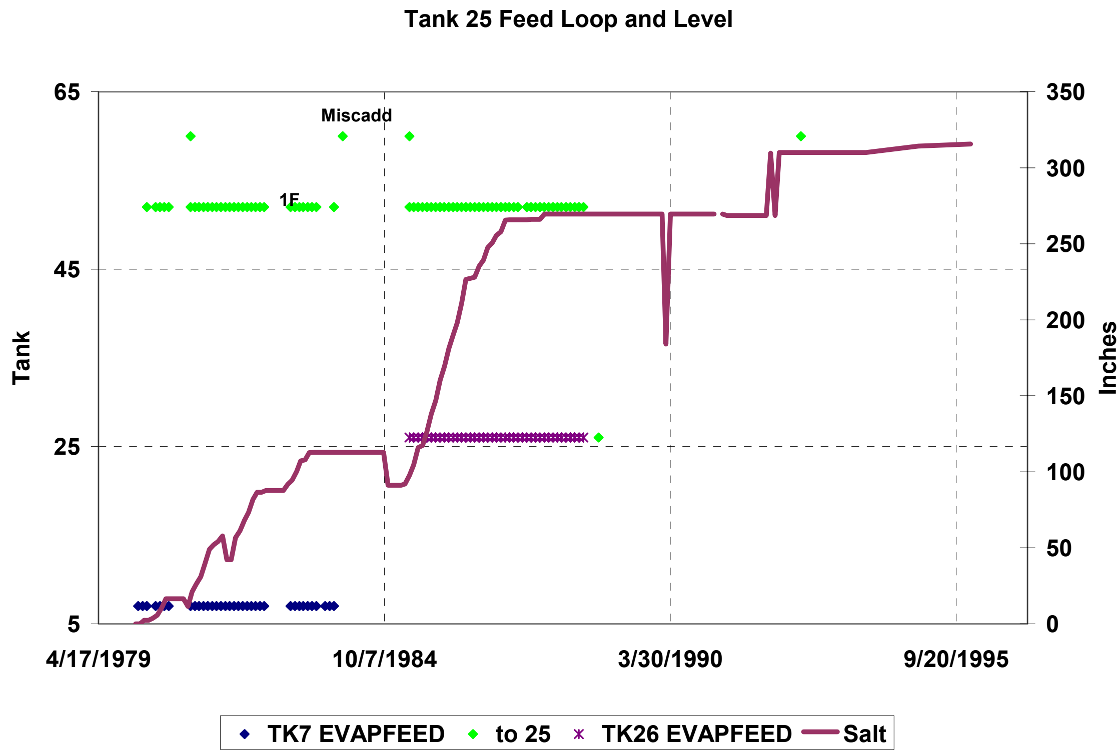


Figure 7: Feed tanks to 1F evaporator with its output to Tank 25 and the salt level

Miscadd: miscellaneous additions

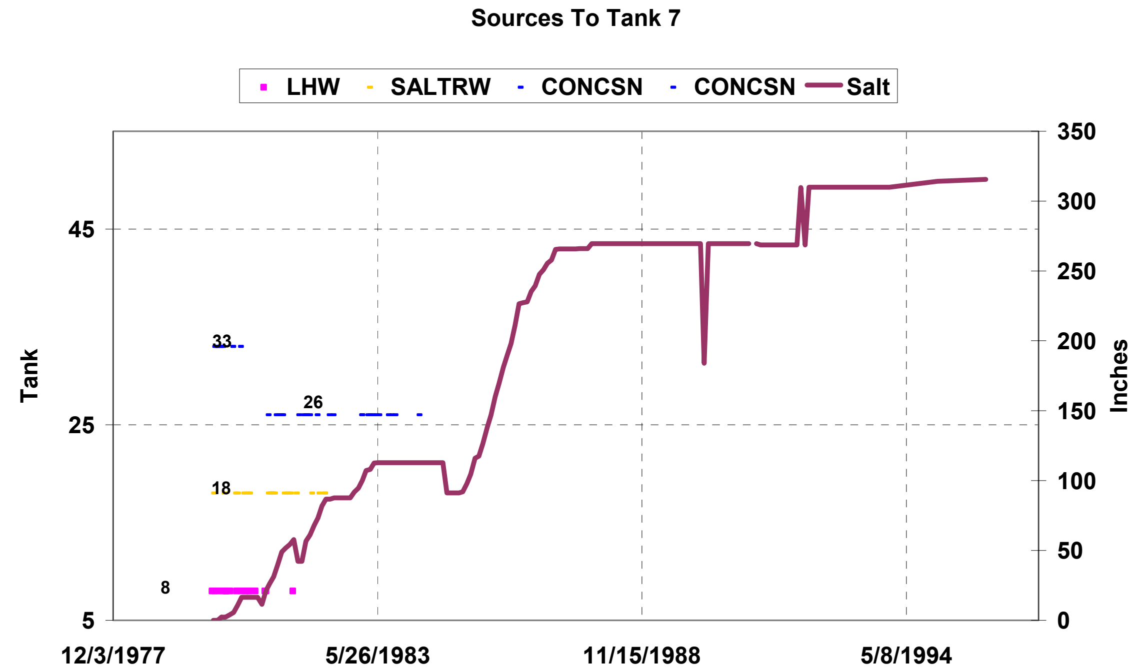


Figure 8: Sources to Tank 7 and Salt level of Tank 25

Note:

SALTRW: Salt Removal Waste

CONCSN: Concentrated Supernatant Liquid

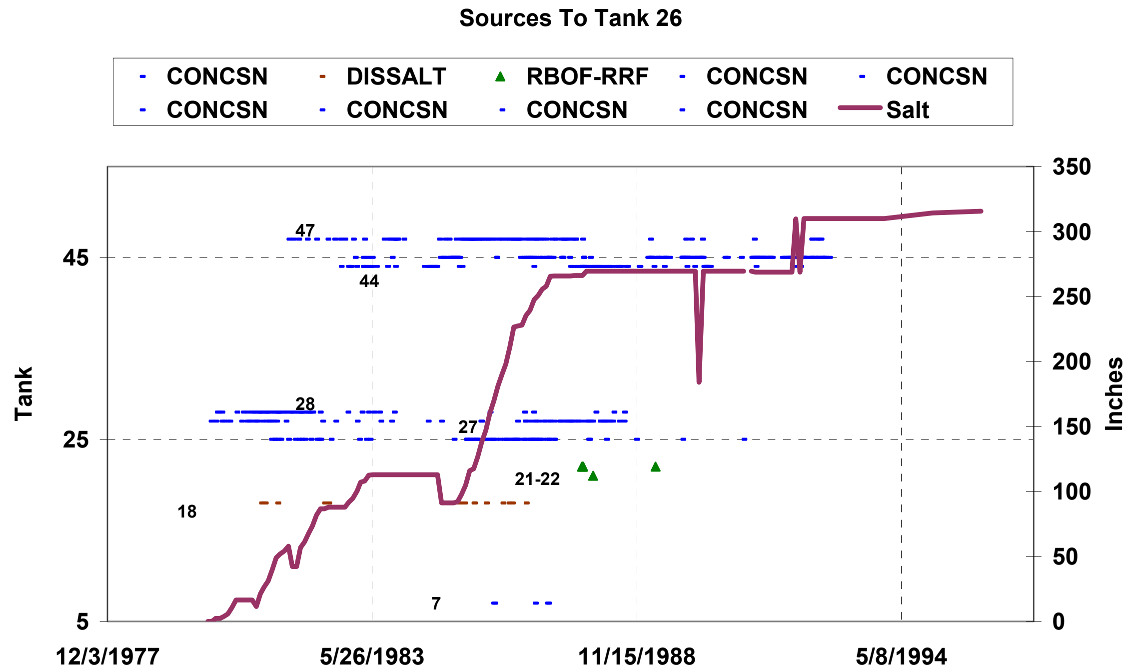


Figure 9: Sources to Tank 26 and Tank 25's Salt Level

RBOF-RRF: Receiving Basin For offsite Fuels from Resin Regeneration Facility that are low in radioactivity and contained less than 1% solid

DISSALT: Dissolved Salt

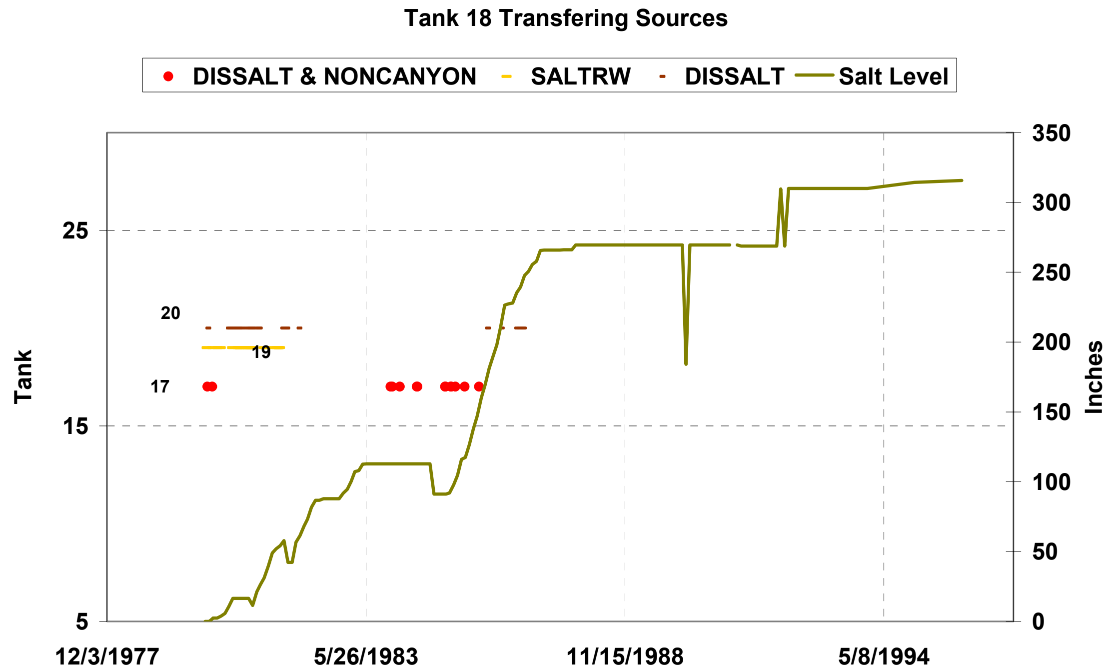


Figure 10: Major input tanks to Tank 18

NONCANYON: Waste came from the 100 Area Trailers and may contain sludge

Section

C

Appendix C – Tank 25 Fill History Charts

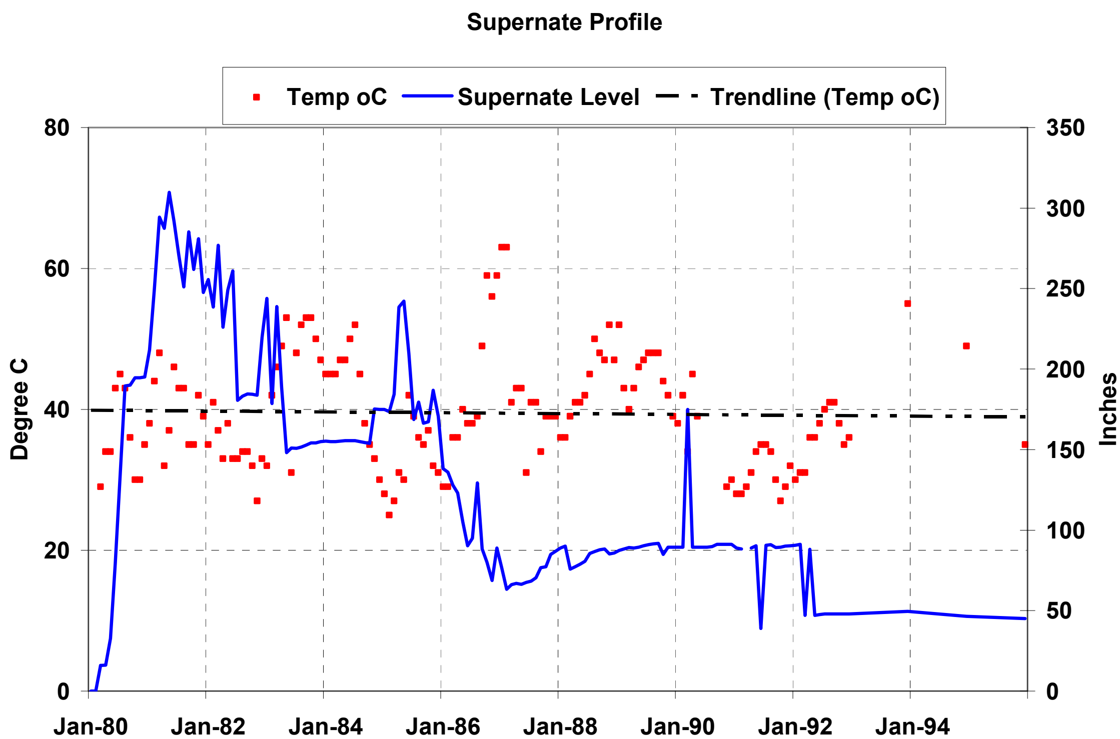


Figure 11: Tank 25 Supernate Profile

Supernate level is the level of supernate obove the saltcake in the Tank 25

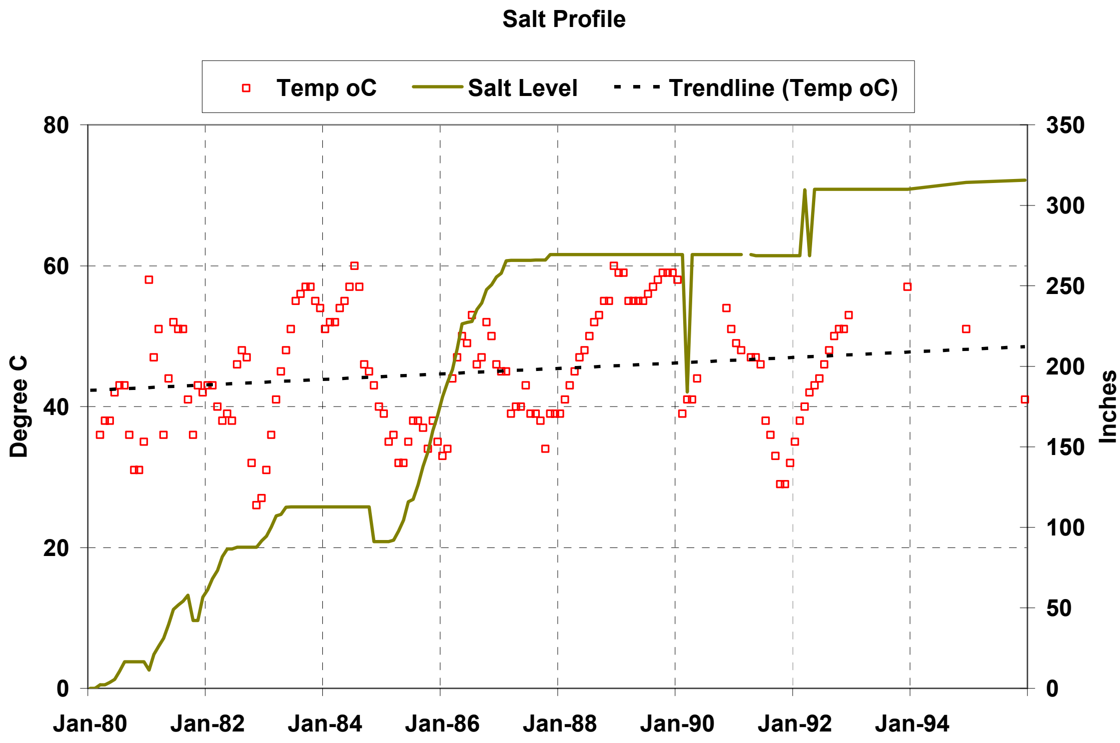


Figure 12: Tank 25 Salt Profile

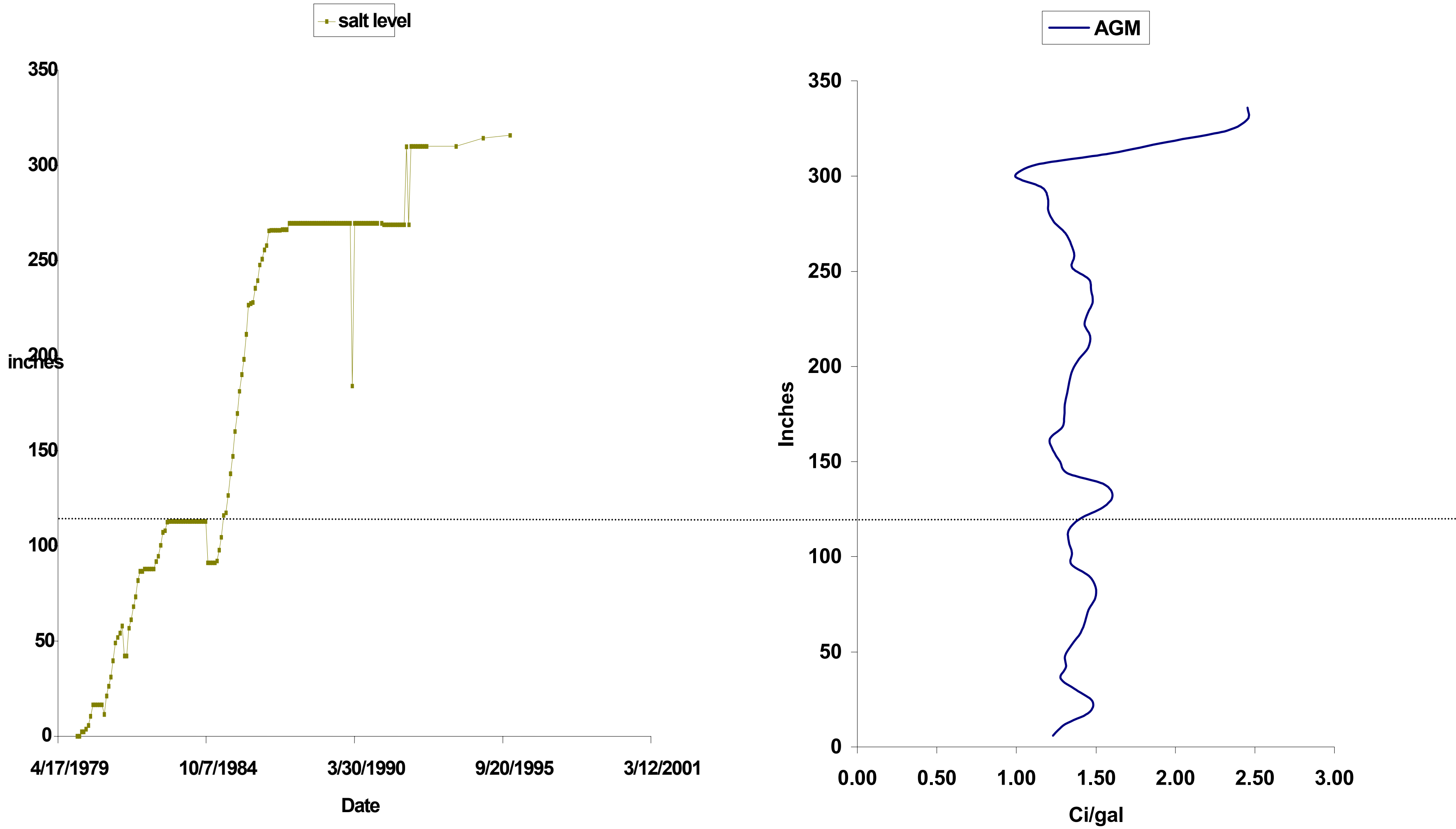
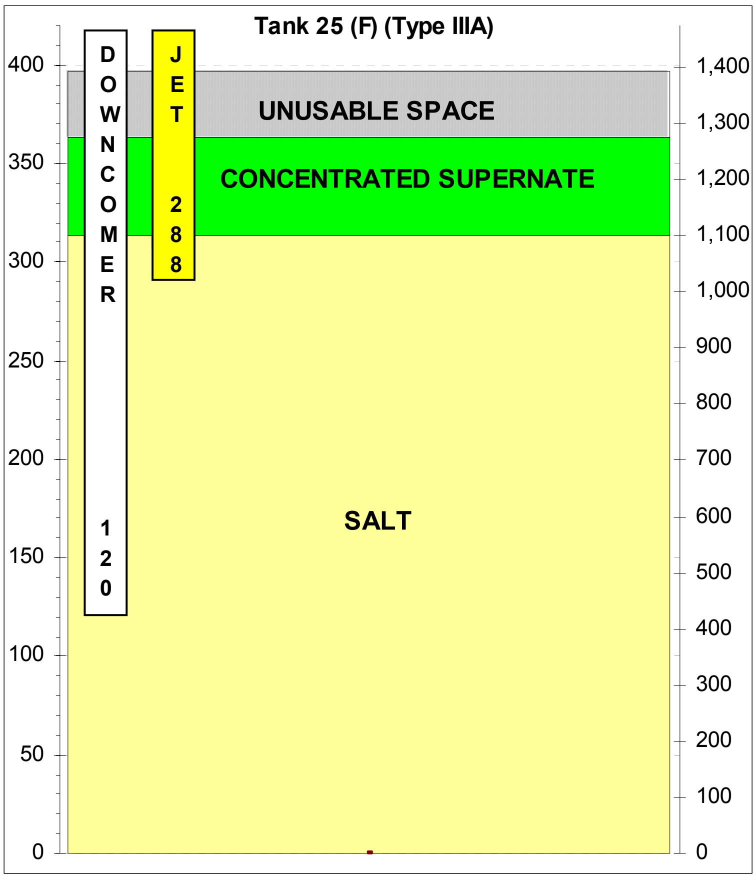


Figure 13: Salt Level and Annulus Gamma Scan Profiles

Section

D

Appendix D – Tank 25 Composite Diagram



NOTE: FOR INFORMATION ONLY.

Figure 14: Tank 25 Composite Diagram with Downcomer and Transfer Jet

Section

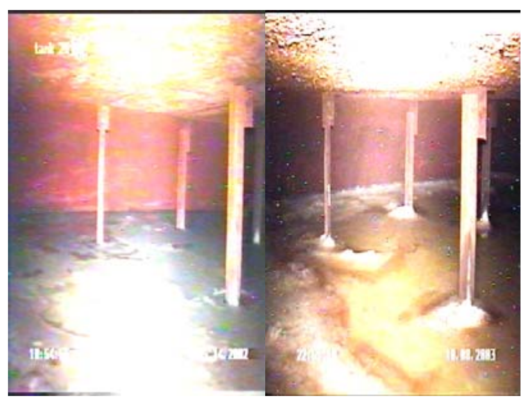
E

Appendix E1 – Tank 25 Interior Views

Reel tape in South riser (1/02)

Riser B2 (5/02)

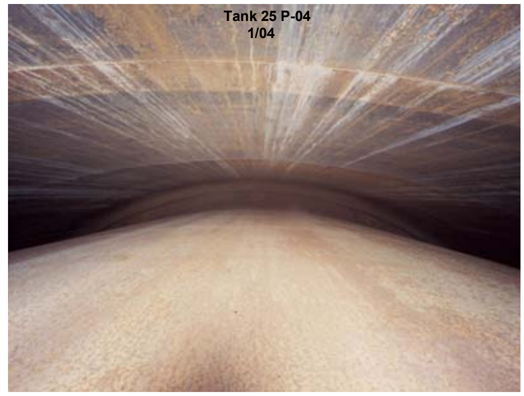
South Riser in 2002 and 2003



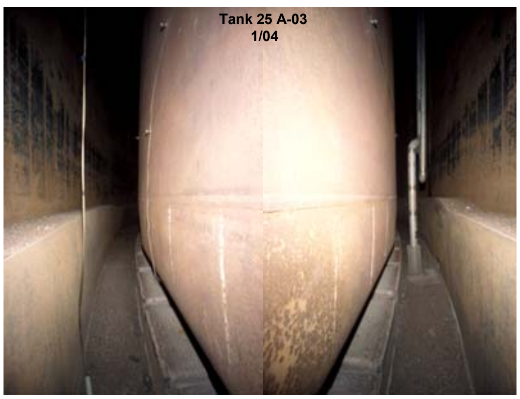
B2 Riser in 2002 and 2003

Appendix E2 – Tank 25 Annulus Views

Port 09 taken in 1/2004



Port 04 taken in 1/2004



Port A03 taken in 1/2004