**WESTINGHOUSE SAVANNAH RIVER COMPANY**
**CONCENTRATION, STORAGE, AND TRANSFER**

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# F/H TANK FARMS WASTE COMPLIANCE PLAN FOR TRANSFERS TO THE EFFLUENT TREATMENT FACILITY

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Paul B. Rogerson
P. B. Rogerson, Author, Waste Characterization Engineering — Date: 3/5/04

H. Bui, Technical Reviewer, Waste Characterization Engineering — Date: 3/5/04

E. J. Freed, Manager, H&F Process Engineering — Date: 3-8-04

A. W. Wiggins, ETP Engineering — Date: 3/16/04

Paul B. Rogerson for P. Hill for W.C. Clark per T/C
W. C. Clark, Manager, H Disposition Project — Date: 3/9/04

Paul B. Rogerson for S.W. Wilkerson per T/C
S. W. Wilkerson, Acting Manager, F Disposition Project — Date: 3/9/04

H. A. McGovern, Manager, Effluent Treatment Project — Date: 3/16/04

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# 1 BACKGROUND AND WASTE GENERATOR RESPONSIBILITIES

The Tank Farms receive waste from a number of sources. The waste is produced as the result of the separation of useful products from spent nuclear fuel and targets. To prevent corrosion of the carbon steel waste tanks, the waste is neutralized with sodium hydroxide and/or sodium nitrite in the Liquid Waste Generators processes before it is sent to the Tank Farms. Neutralizing the waste produces a mixture of insoluble sludge suspended in a salt solution. Any insoluble species in the waste settle to the bottom of the tank, forming a layer of sludge at the bottom, with a layer of supernate above it.

To reduce the cost of storage and improve the safety of storage, the supernate is evaporated to reduce its volume and mobility. The overheads from the evaporators are condensed and sent to a mercury collection tank where mercury is collected. After passing through the mercury collection tank, the overheads may be treated by passing them through a cesium removal column to remove residual Cs-137. This step is omitted for overheads that have been sufficiently decontaminated by the evaporator. Once all treatment steps in the evaporator system are completed, the overheads are sent to ETF for further decontamination and eventual release to the environment.

The ETF basins are provided to temporarily hold non-routine waste streams containing high levels of radioactivity resulting from process upsets at HLW facilities and Separations facilities. Storm zones are diverted when the tank farms are conducting liquid waste transfer, or when a zone's water monitor is out of service or initiates a false alarm due to administrative or precautionary reasons.

The ETF WAC designates the waste generators as responsible for:[1,2]

- developing, implementing and maintaining a waste certification program in accordance with the respective facility's approved Waste Certification Plan;
- their waste throughout its full life cycle;
- all cost incurred as a result of a noncompliance;
- allocation of adequate funding and resources to support the waste certification process;
- characterizing waste with sufficient accuracy per WAC 4.02 to permit proper segregation, treatment, storage, and disposal;
- identifying the Organization of the waste generator's (this should include the appropriate Engineering, Operations, Generator Certification Official lines of structure.

Attachment 1 contains the Organization charts for Liquid Waste Disposition and Liquid Waste Engineering.

## 2 PROCESS DESCRIPTION

The purpose of the evaporator systems is to reduce the amount of liquid volume of high-level radioactive waste resulting from the nuclear processing. The boiling action in the evaporators causes the liquid to separate from the waste. The separation of the liquid from the waste reduces the waste volume to about 25% to 30% of the original volume.

**Note: The description below is a generic description of the operation of the 242-H, 242-16H, 242-16F and 242-25H evaporators.**

The waste in the evaporators is boiled using steam and separated into vapor and concentrated liquid. The concentrate is lifted out of the evaporator and gravity-drains down to a concentrate receipt tank. The overheads are cooled in the condenser. The overheads then enter the mercury removal tank where mercury in the overheads settles to the bottom of the tank for removal. The overheads tank is sampled for gamma activity. If the gamma activity is low, the overheads are directed to the Effluent Treatment Facility (ETF). Operating experience with the existing waste evaporators shows that the decontamination factor (DF, defined as the concentration of activity in the pot divided by the concentration of activity in the condensate) is approximately $10^4$ to $10^5$.[3,4] The 242-25H evaporator will provide a DF in the range of $10^6$ to $10^8$.[5] Overheads that do not sample within limits are returned to the feed tank and recycled back to the evaporator to further remove contaminants. Figure 1 presents a basic evaporator flow diagram.

The principal evaporator overheads components are summarized below.

Condenser – The condenser removes the heat from the overheads to condense them.

Mercury Removal Tank – The purpose of the mercury removal tank is to allow mercury from the overheads to settle, whereupon it is removed through a manually operated drain valve at the bottom of the tank.

Cesium Removal Column – The cesium removal column acts as an ion exchanger to remove cesium from the overheads.

Overheads Tanks – The overheads tanks collect and hold the condensed vapor until sample. It allows continuous operation of the evaporator by collecting vapor in one tank while the other tank is being sampled.

Overheads Sampler – The overheads sampler takes a sample to determine if the overheads meet the ETF limits. If the levels are higher than the ETF limits, then the overheads are sent to the feed tank to be reprocessed.

The Tank Farms receive incoming waste from a number of sources. Eventually, the waste is fed to the evaporators. The waste sources include, but are not limited to the following:[6]

- F-Canyon (Separations, including outside facilities)
- H-Canyon (Separations, including outside facilities)

- RBOF/RRF
- ETF
- Reactor Areas
- SRTC
- Analytical Laboratory Facilities
- Other Site Facilities
- Waste generated from decommissioning of tanks or other facilities

The Tank Farms receive the following recycle streams from within the HLW System:

- Spent decontamination solutions from the Tank Farm Maintenance Facility (299-H)
- Spent Wash Water from Sludge Processing
- Recycle from DWPF
- Highly contaminated cooling water or storm water
- Other internally generated streams

# 3 ETF WASTE ACCEPTANCE CRITERIA

## 3.1 Physical/Chemical

### 3.1.1 Volatile Organic Material

The organics in high-level waste are primarily the soluble residue of tri-butyl phosphate and n-paraffin used in the solvent extraction process in the canyons. These are relatively heavy organics, both of which have boiling points higher than water. Organics resulting from ion exchange resins (digested and undigested) were also received from the canyons. Only a small amount of ion exchange resins will be transferred to the Tank Farms due to the limited processing plans of the canyon facilities. Smaller quantities of organic constituents from RBOF and DWPF are also received in the Tank Farms. The Tank Farms contains more inorganic resins than organic resins, but inorganic resins (e.g., zeolite) do not decompose and form flammable constituents. Therefore, inorganic resins do not have a flammability concern from thermal, chemical or radiolytic decomposition.[7] Another source of organic material is from the defoaming agents used in the evaporators. The organic constituents that are present in the defoaming agents are not expected to contribute significantly to the composite lower flammability level due to the limited quantities and the significant dilution from the tank farm supernatant.[7]

The Table below summarizes the most current waste tank data for organics (O/A vol.% – organic over aqueous). Currently, the organic content of incoming waste streams into the Tank Farm waste tanks is limited to <0.5 vol.% O/A.[12] This limit was established to ensure the vapor space in the waste tanks is non-flammable.

**Table 1 – Waste Tank Organic Content Sample Data**[8]

| Waste Tank | O/A vol.% |
|---|---|
| 26 | 0.001 |
| 33 | 0.024 |
| 38 | 0.010 |
| 43 | 0.029 |
| 46 | 0.003 |

The Tank Farm Documented Safety Analysis (DSA) requires the organic content of a waste tank contribute less than 5% to the hydrogen LFL at 100°C.[9] Therefore; the concentration of organics (if any) in the evaporator overheads should not produce (at equilibrium) vapors in the flammable or explosive range during normal operations at ETF. Samples from the 242-16F, 242-16H and 242-25H evaporator overheads submitted for analysis in the SRTC Lab were analyzed for a few specific organic compounds.[10] Table 2 below summarizes the organic compound results.

**Table 2 – Organic Compounds**

| Species | ETF WAC Limit (mg/l) | 242-16H Evaporator Overheads (mg/l) | 242-16F Evaporator Overheads (mg/l) | 242-25H Evaporator Overheads (mg/l) |
|---|---|---|---|---|
| Butanol | - | 1.4 | 12 | <0.01 |
| Phenol | 50 | <1 | <0.1 | <0.1 |
| TBP | 50 | <1 | <0.1 | <0.1 |
| DBP | - | <5 | <5 | <5 |
| benzene | 3 | <0.001 | <0.001 | <0.001 |

**Note**: The sample data corresponds to the samples pulled on:

April 2003 – 242-16H evaporator

March 2003 – 242-16F evaporator

March 2003 – 242-25H evaporator

The phenol, benzene, and the TBP concentrations are within the ETF WAC limits.

### 3.1.2 Toxic Gases, Vapors and Fumes

Currently ammonia is received in the Tank Farms from the Separations facilities. Ammonium nitrate collects on the vessel vent filters in the Separations canyons. When these filters are flushed, the canyons make the flush solutions strongly alkaline by the addition of sodium hydroxide prior to transfer. Due to the high hydroxide concentration

(~1.1 M) essentially all of the ammonium nitrate exists as ammonia. Therefore, most of the ammonia evolves and evaporates into the pump tank and waste tank vapor space. The DWPF is presently processing sludge only (no salt). Recycle from DWPF containing trace concentrations of ammonia is received in H-Tank Farm.

The Tank Farm WAC limits the amount of ammonia to less than 0.127 wt% (1650 mg/l) to maintain the equilibrium vapor phase ammonia concentration to less than or equal to 15% of the Lower Explosive Limit (LEL).[11] The final ammonia supernate concentration will be less than the incoming waste streams due to the dilution factor added by the waste tank contents.

In 1976 the canyons changed their processing flowsheet to reduce the amount of ammonia generated by destroying hydrazine and sulfamate with nitrite. This change resulted in a 94% reduction in the ammonia sent to the tank farms.[7]

**Table 3 –Evaporator Overheads Ammonium Sample Results**

| Evaporator | $NH_4^+$, (mg/l) |
|---|---|
| 242-16H | <10 |
| 242-16F | 91 |
| 242-25H | 7 |

**Note**: The sample data corresponds to the samples pulled on:

April 2003 - 242-16H evaporator

March 2003 - 242-16F evaporator

March 2003 - 242-25H evaporator

Samples of the 242-16F, 242-16H and 242-25H evaporator overheads sent to the SRTC Lab for analysis have been analyzed for the ammonium ion ($NH_4^+$).[10]

### 3.1.3 Listed Waste

No RCRA hazardous 'listed' waste is allowed to be transferred into the Tank Farm waste tanks.[12] Therefore, no hazardous 'listed' waste will be transferred to ETF as part of the evaporator overheads.

### 3.1.4 Chemical Contaminants

The waste stored in the High-Level Waste tanks in F Area and H Area is a complex mixture of insoluble and soluble chemical compounds that were generated from chemically processing nuclear materials at the Savannah River Site. The waste is hazardous due to the presence of hydroxide, nitrite and various soluble and insoluble chemical compounds of toxic metals (i.e., lead, silver, cadmium, selenium). The principal chemicals present in the evaporator overheads are the chemicals present in the high-level waste liquid waste (supernate) evaporated. The major chemicals are the corrosion inhibitors needed to prevent corrosion of the carbon steel waste tanks and equipment. These major species include hydroxide, nitrite, and nitrate. No other chemicals are added to the waste tanks besides the aforementioned inhibitors, chemicals received in the incoming waste streams, and small quantities of defoaming agents used in the evaporators. The incoming waste streams are evaluated before receipt into the Tank Farms and the concentration of any chemicals is limited per the Tank Farm WAC.[12]

Table 4 below summarizes the most recent chemical contaminants results for the 242-16F, 242-16H and 242-25H overheads samples sent to the SRTC Lab for analysis.[10]

## Table 4 – Chemical Contaminants

| Species | ETF WAC limit (mg/l) | 242-16H Evaporator (mg/l) | 242-16F Evaporator (mg/l) | 242-25H Evaporator (mg/l) |
|---|---|---|---|---|
| Ammonium | 150 | <10 | 91 | 7 |
| Ag | 1 | <0.009 | <0.009 | <0.009 |
| As | 1 | <0.05 | <0.025 | <0.025 |
| B | 6 | 0.031 | <0.08 | 0.04 |
| Ba | 2 | <0.021 | <0.021 | <0.021 |
| Be | 5 | 0.068 | <0.002 | <0.002 |
| Ca | 22.9 | 0.125 | 0.608 | <0.025 |
| Cd | 0.6 | <0.005 | <0.005 | <0.005 |
| Cr | 5 | <0.007 | <0.007 | <0.007 |
| Cu | 2 | <0.001 | 0.014 | 0.015 |
| Hg | 6 | 0.656 | 0.142 | 0.601 |
| K | 1000 | <0.150 | <0.150 | <0.150 |
| Mg | 13 | 0.014 | 0.074 | <0.006 |
| Mn | 31 | <0.001 | <0.001 | <0.001 |
| Na | 600 | 3.72 | 1.5 | 2.7 |
| Ni | 2 | <0.015 | <0.015 | <0.015 |

**Note**: The sample data corresponds to the samples pulled on:

April 2003 – 242-16H evaporator

March 2003 – 242-16F evaporator

March 2003 – 242-25H evaporator

**Table 4 – Chemical Contaminants (Continuation)**

| Species | ETF WAC limit (mg/l) | 242-16H Evaporator (mg/l) | 242-16F Evaporator (mg/l) | 242-25H Evaporator (mg/l) |
|---|---|---|---|---|
| Pb | 2 | 0.054 | <0.035 | <0.035 |
| Phenol | 50 | <1 | <0.1 | <0.1 |
| Sb | 40 | <0.416 | <0.416 | <0.416 |
| Se | 1 | <0.025 | <0.025 | <0.025 |
| Si | 5 | 1.61 | 3.4 | 0.385 |
| Sn | 2 | - | - | - |
| TBP | 50 | <1 | <0.1 | <0.1 |
| Zn | 40 | 0.007 | <0.004 | 0.033 |
| Nitrate | 1600 | <1 | <1 | <1 |
| Nitrite | 300 | <1 | <1 | <1 |
| Sulfate | 40 | <0.5 | <0.5 | <0.5 |
| Aluminate | 100 | - | 0.21 | <0.14 |
| Carbonate | 200 | <120 | <120 | <120 |
| Fluoride | 100 | <0.2 | <0.2 | <0.2 |
| Phosphate | 100 | <1 | <1 | <1 |
| Oxalate | 100 | <1 | <1 | <1 |
| Chloride | 70 | 0.7 | <0.2 | <0.2 |
| **Other Limits** | | | | |
| TOC | 100 | 2.51 | 10.1 | 1.64 |
| TSS | 40 | <10 | 70 | 130 |
| particle size | 40 MESH (350 micron) | BDL | BDL | BDL |
| benzene | 3 | <0.001 | <0.001 | <0.001 |
| EDTA | 5 | <5 | <20 | <20 |
| methanol | 2 | - | - | - |
| isopropanol | 50 | <0.01 | <0.01 | <0.01 |
| other volatiles | 20 | <0.01 | <0.01 | <0.01 |
| pH | 1-12.5 | 7.97 | 10.2 | 9.31 |

**Notes to Table 4:**

1. "-" Represents that a value was not reported and no sample data is available.
2. The table was updated with the most recent annual sample data available.[10]
3. BDL represents below detection limit.

The only current source of phenol is tetraphenylborate (TPB). The Tank Farm WAC and the Tank Farm SAR prohibits transfers of liquid waste into the waste tanks containing TPB unless an evaluation is performed. Therefore, the ETF limit could not be exceeded.

## 3.2 Radioactive Inventory

Since tritium is evaporated in the HLW evaporators all the tritium present in the supernate during evaporation will be transferred to the ETF in the overheads. Actual overheads and supernate data shows concentration of tritium in the range of $10^5$ dpm/ml. Refer to Table 5 below. Therefore, it is expected that the tritium limit could be exceeded. A deviation request for tritium is included as part of this WCP.

**Table 5 - Tritium sample Data:**

| | dpm/ml |
|---|---|
| 242-16F Overheads | 4.02E4 |
| F catch tank | 1.48E4, 1.42E4 |
| 26F | 3.63E5 |
| 33F | 4.70E3 |
| 46F | 3.29E5 |
| 47F | 6.83E4 |
| 242-16H Overheads | 1.07E3 |
| 29H | 4.67E4 |
| 30H | 4.4E5 |
| 32H | 5.33E5 |
| 35H | 7.31E5 |
| 36H | 1.29E5 |

The most recent evaporator overheads annual sample data shows a tritium activity of 1,070 dpm/ml for the 242-16H evaporator, 40,200 dpm/ml for the 242-16F evaporator, and 91,500 dpm/ml for the 242-25H evaporator.[10]

**Table 6 - Evaporator Overheads Iodine –129 Sample Data:**[13]

| Evaporator | dpm/ml |
|---|---|
| 242-16F | <1.32 |
| 242-16H | 0.147 |
| 242-25H | <1.39 |

The concentration of I-129 in supernate for some Tanks is summarized in Table 7 below.[14] Overheads sample data shows the limit has not been exceeded.

**Table 7 – Iodine-129 in HLW Supernate**

| Waste Tank | I-129 (dpm/ml) |
|---|---|
| 11 | 2E2 |
| 32 | 2E2 |
| 12 | 6E2 |
| 15 | 6E2 |
| 30 | 6E2 |
| 9, 10 | 4 |

Table 8 below summarizes the most recent overheads sample data.[10]

**Table 8 – Radioactive Contaminants**

| Radionuclides | ETF Limit (dpm/ml) | 242-16H Evaporator (dpm/ml) | 242-16F Evaporator (dpm/ml) | 242-25H Evaporator (dpm/ml) |
|---|---|---|---|---|
| H-3 | 1.2E5 | 1070 | 4.02E4 | 9.15E4 |
| Cs-137 | 1.2E3 | 182 | 745 | 207 |
| Gross Alpha | 1.0E2 | <1.56 | <8.23 | <9.18 |
| Gross Beta/Gamma | 2.5E3 | 200 | 781 | 267 |
| C-14* | 2.5E3 | <13.7 | <14.9 | <14.9 |
| Ni-59 | 2.5E3 | <16.0 | <14.9 | <29.4 |
| Ni-63*** | 2.5E3 | - | - | - |
| Co-60 | 1.3E1 | <29.3 | <1.01 | <0.732 |
| Se-79** | 5.0E1 | <7.28 | <3.6 | <2.48 |
| Sr-90 | 1.8E2 | <26.5 | <55.6 | <62.7 |
| Y-90 | 1.8E2 | <26.5 | <55.6 | <62.7 |
| Nb-94 | 6.3E1 | <24.7 | <1.02 | <1.02 |
| Tc-99 | 2.5E3 | <5.64 | <3.76 | <3.76 |
| Ru-106 | 7.9E2 | <202 | <22.9 | <14 |
| Rh-106 | 7.9E2 | <202 | <22.9 | <14 |
| Sn-126 | 7.0E2 | <37.5 | <3.19 | <2.12 |
| Sb-125 | 2.5E2 | <77.7 | <12.6 | <7.15 |
| I-129 | 1.0E0 | 0.147 | <1.32 | <1.39 |
| Cs-134 | 2.5E3 | <27.3 | <1.33 | <1.42 |
| Eu-154 | 2.5E1 | - | <3.15 | <2.09 |
| Np-237 | 1.3E-1 | <1.5 | <0.36 | <0.36 |
| Pu-241** | 1E2 | <11.9 | <4.8 | <5.39 |
| RCG | 1.2E-2 | 6.22E-3 | 7.86E-3 | 2.34E-3 |

RCG = (0.0145[Co-60] + 0.0078[Ru-106] + 0.013[Sb-125] + 0.022[Cs-137] + 0.061[Eu-154] + 0.0705[Sn-126])/2200

**Notes to Table 8:**

1. "-" Represents a value was not reported.

The sample data corresponds to the samples pulled on:

April 2003 – 242-16H evaporator

March 2003 – 242-16F evaporator

March 2003 – 242-25H evaporator

The analysis results reported in Tables 4 and 8 are documented in reference.[10] Most of the species were below their limit of detection for the analysis method.

No sample data is available for Ni-63. Nickel-63 is an activation product that is expected to be present in HLW in very small quantities (below detection limits). Therefore, it will be exempted from any characterization.

### 3.3 ETF Basins

The discussion that follows is credited to reference 15.

Water that is diverted to the ETF basins could contain a wide variety of radionuclides. Historically, waste tank supernate has been the most likely source because that was the only material routinely moved around the tank farm (e.g., feeding the evaporators). Now that waste removal and processing operations are becoming more common, the range of likely compositions is widening. The curie content of a real contaminated diversion could vary widely, and the actual radionuclide distribution will have to be determined after the event. In ETF's first 5.5 years operating history, only one real diversion occurred, although ETF's original design basis anticipated a frequency of about one per year. Regardless of the frequency, when the water is contaminated, it can be sent to the ETF treatment plant, the water can be sent to the tank farms, or alternative treatment could be provided (e.g., Chem-Nuclear treated the 1989 diversion).

In the basins' influents, slight amounts of activity and chemicals can be absorbed on dirt particles, and the larger suspended particles typically settle out in the large basins. Periodically the basins are emptied and any accumulated sediment is removed. Table 9 below summarizes sample result of the ETF basins' sediments. These results are an initial representation of the concentration of contaminants that could reach the ETF basins when a diversion occurs. As indicated in the previous paragraph, the actual concentration of contaminants will have to be determined after a real diversion occurs.

**Table 9 – ETF's Retention Basins' Sediment Data[15]**

| | F-Area Retention Basin | H-Area Retention Basin | |
|---|---|---|---|
| Sample date | 03/93 | 05/31/91 | 03/93 |
| As* | - | - | <0.20 |
| Ba* | - | - | 1.074 |
| Cd* | - | - | <0.10 |
| Cr* | - | - | <0.05 |
| Pb* | - | - | <0.50 |
| Hg* | - | - | <0.0121 |
| Se* | - | - | <0.10 |
| Ag* | - | - | <0.05 |
| Co-60♦ | ND | ND | ND |
| Cs-137♦ | ND | 1.11 | 1.8 |
| Am-241♦ | ND | ND | ND |
| Others♦ | ND | 0.016 (Cs-134) | ND |

*Units are in mg/l.
♦Units are nCi/g

Currently the Tank Farms divert the storm zones when transfers are conducted, when a zone's water monitor is out of service or initiates a false alarm. The storm water systems are sampled daily. If the storm water monitor is on the credible transfer path of a transfer, it is sample every six hours. Likewise, if the monitor is out of service it is also sampled every six hours.[16] In addition, procedures require notification to ETF and WPT when there is a diversion of the Storm Water System from the Creek to the Basin. In the event of a real diversion (e.g., emergency during a liquid waste transfer), the F/H Tank Farms in conjunction with ETF will determine what actions are to be performed for the safe management of the waste and future processing. In the event high levels of lead and/or copper are found in the basins (during ETF's annual sampling of the basins), the Tank Farms will support the ETF in determining the source of the contamination. This could include sampling of the storm water system.

### 3.4 Catch Tank Transfers into ETF

H-Area catch tank was designed to collect waste leaked into HDB-1 and the concrete encasements, which contain transfer pipes, from waste tanks 9-16.[9] The catch tank mostly consists of rainwater which has soaked through the concrete encasements. The catch tank has a capacity of 11,700 gallons and is enclosed in a cell.[9] There is no overflow line on the catch tank, and in the event that the catch tank volume capacity is exceeded, the liquid will begin to back up in the concrete encasements which drain to the tank.[9] In order to prevent the catch tank from overflowing into the concrete encasements, the catch tank contents are transferred to ETF. Table 10 summarizes the most recent sample results of the catch tank contents.

F-Area catch tank was designed to collect waste leaked into FDB-1 and certain line encasements.[9] The contents of F-Area catch tank are sent to Tank 26; therefore, this WCP is not applicable to F-Area catch tank. However, in the future, if F-Area catch tank contents are to be sent to ETF this WCP must be revised.

**Table 10** - H-Area Catch Tank Sample Data[17]

| Date | Gamma (dpm/ml) | Alpha (dpm/ml) | Beta-Gamma (dpm/ml) | pH |
|---|---|---|---|---|
| 6/18/99 | | <1 | 83 | 8.54 |
| 7/14/99 | | <1 | <100 | 8.45 |
| 8/24/99 | | <1 | <100 | 8.45 |
| 9/7/99 | | 2 | 131 | 8.40 |
| 9/17/99 | | <1 | <100 | 8.96 |
| 2/11/00 | 176 | <25 | 592 | 8.62 |
| 5/19/00 | 145 | 25 | 100 | 8.44 |
| 9/25/00 | 189 | <25 | 92 | 8.587 |
| 1/23/01 | 204 | <25 | 167 | 8.68 |
| 3/31/01 | | <1 | 73 | |
| 7/5/01 | 125 | 26.7 | <100 | 8.419 |
| 1/6/02 | 206 | <1 | 227 | 8.548 |

## 3.5 Criticality

Waste received in the Tank Farms shall be inherently safe with respect to criticality for any concentration and mass in the uncontrolled geometry of the waste tanks. The concentration of fissile material in high level waste supernate is limited by solubility. The concentration of fissile material in the evaporator overheads is assessed or monitored by the ETF total alpha activity limit. The 100 dpm/ml alpha limit represents a very small amount of fissile material. The two main isotopes in HLW considered for criticality purposes are Pu-239 and U-235. If the alpha activity limit is assumed to be Pu-239, the concentration of Pu-239 in the supernate will have to be ~8 mg/l (5 times higher than the Pu solubility limit in supernate). Assuming all alpha is U-235, the U-235 concentration in supernate will be ~2E5 mg/l (at least $10^3$ times greater than the U solubility limit in supernate). Therefore, it is incredible that fissile material in the overheads will approach concentrations that could cause a criticality event.

## 3.6 Administrative Controls

### 3.6.1 Compliance Plan

The method to ensure compliance with the ETF WAC is through historical supernate sample data, fission yield data, and sampling of the evaporator overheads. The evaporator overheads transferred to the ETF are the result of the evaporation of the supernate contained in the high level waste tanks. Therefore, available supernate data can be used to demonstrate that after evaporation, the transferred overheads will meet the ETF WAC limits. Any changes in influents into the Tank Farms will be evaluated per the Tank Farm WAC, and impacts in processing (evaporation) will be assessed. Any impacts to the characterizations of the overheads will require revision of this WCP (including Deviations) and approval by ETF.

### 3.6.2 Overheads Sampling Schedule

Sample analysis results are included in this WCP, and will be provided to ETF in a separate technical report. Evaporator overheads samples will be analyzed according to the schedule below.

**Table 11 - Sample and Analysis Schedule for the Evaporator Overheads**

| Monthly | | Annually | |
|---|---|---|---|
| **Species** | **Lab** | **Species**** | **Lab** |
| Tritium | ETF | Species from Attachments 1 and 2 of WAC 4.02. | SRTC |
| Total β/γ | ETF | | |
| Total α | ETF | | |
| NH3+ | ETF | | |
| Si | ETF | | |
| Hg | ETF | | |
| Oil & Grease | ETF | | |
| pH | ETF | | |

** Except Ni-63 and Rh-106. These species do not exist in the waste due to their short half-life or very small quantities.

**Notes:**

1. The Annual sample results will be provided to ETF within three month of the sample(s) being taken for those samples sent to the SRTC lab for analysis.
2. The Monthly samples are analyzed by the ETF laboratory and the results are reported to both the Tank Farm facility and ETF as soon as the results are obtained.

3.6.3 Deviations to the ETF WAC

A list of those ETP WAC requirements for which the Tank Farms have currently approved active deviation requests will be maintained in the Tank Farm ERD (N-ESR-G-00001). For temporary deviations, the expiration date of these deviations will be listed as well. Future deviation requests will be requested on the form identified in the 1S Manual, OSR 29-41. Proper justification for the deviations will be included in the deviation request form.

3.6.4 Documentation

Procedures are used to sample the evaporator overheads and to transfer the overheads to ETF. Samples from the evaporator overheads will be analyzed, and the results will be provided to ETF in a separate technical report.

3.6.5 Waste Characterization Non-Compliance

ETF will be notified of any non-compliance with this WCP and the ETF WAC. The PIR and SIRIM procedures are to be invoked as appropriate. The Tank Farm WAC requires the Liquid Waste Generators to characterize the waste sufficiently for CST to demonstrate that the Tank Farms' ability to meet various criteria imposed by the downstream processing facilities will not be impaired. CST will participate in any corrective actions resulting from a non-compliance.

## 4 ATTACHMENTS

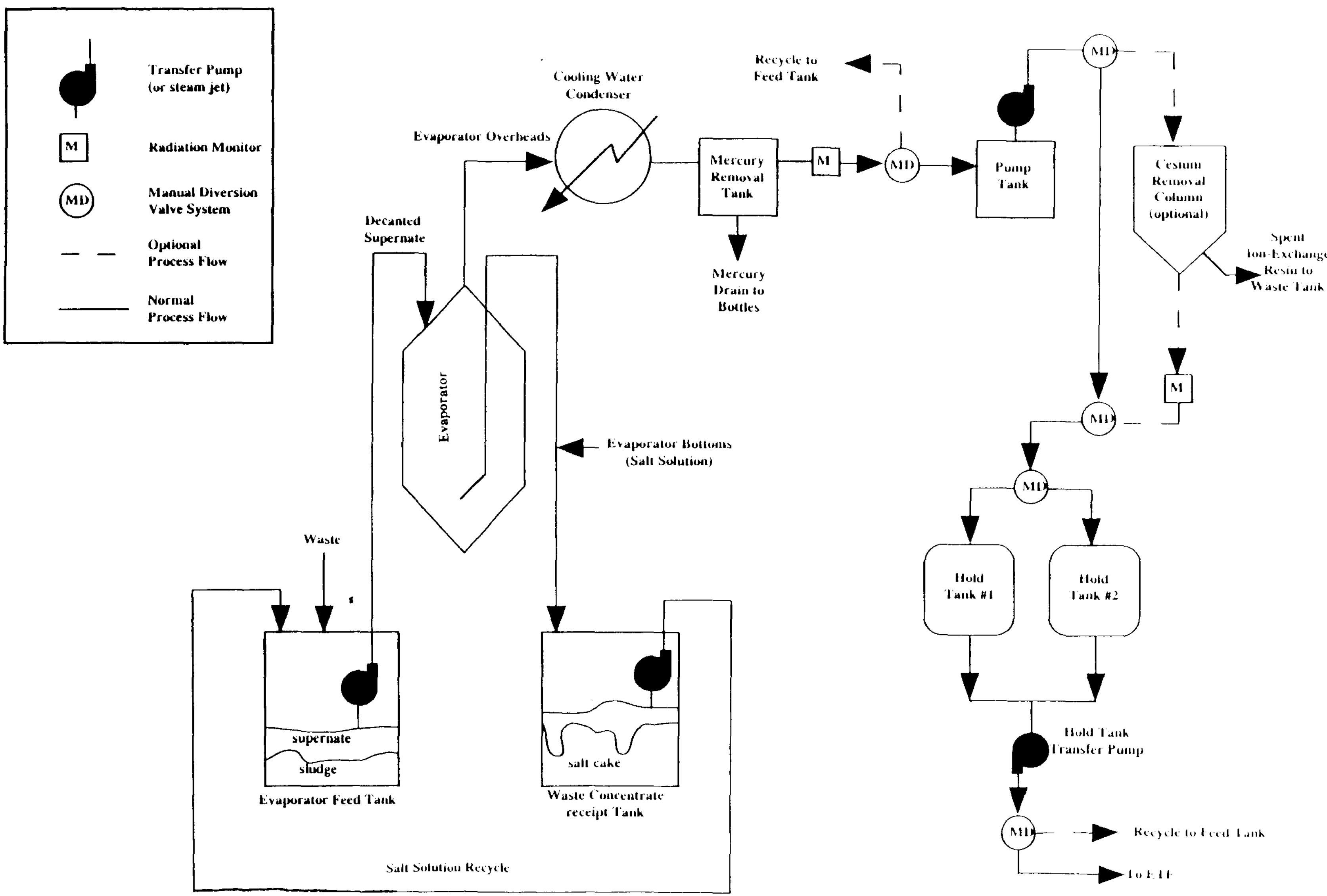


Figure 1 – Basic Evaporator Flow Diagram

**Attachment 1 – Organization Charts**

## W0000 - CLOSURE BUSINESS UNIT (96713)

Parent: A0000 - WSRC STAFF

Switch to Financial View

**4,302 Total Personnel Assigned on Administrative Org Tree for W0000**

| | | | |
|---|---|---|---|
| W0000 | **14** CLOSURE BUSINESS UNIT | **96713** DEVINE, JOHN C. |
| ± WA0000 | **814** H-COMPLETION PROJECTS | **92246** OLSON, LYDEN D. |
| ± WB0000 | **644** F AREA CLOSURE PROJECTS | **92295** SAIN, LEO H. |
| ± WC0000 | **505** WASTE SOLIDIFICATION AREA PROJ | **91516** FRENCH, JAMES W. |
| ± WD0000 | **249** SITE D & D | **92933** FERRI, MARK S. |
| ± WE0000 | **1,170** LIQUID WASTE DISPOSITION PROJ | **91473** HAYES, DENNIS L. |
| ± WF0000 | **328** SOIL AND GROUNDWATER CLO PROJ | **93000** SABBE, MICHAEL A. |
| WH0000 | **7** HUMAN RESOURCES OPER MANAGER | **91481** MALARKEY, CHARLES J. |
| ± WJ0000 | **124** BUSINESS UNIT MANAGER ENGINEER | **96396** ARMITAGE, CHARLES E. |
| ± WK0000 | **73** MAINTENANCE | **91499** CAMPBELL, CHARLES R. |
| ± WL0000 | **313** LABORATORIES MANAGER | **99190** PADEZANIN, PATRICIA C. |
| ± WM0000 | **61** BUSINESS MANAGEMENT | **92850** CONDON, WILLIAM A. |

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## WE0000 - LIQUID WASTE DISPOSITION PROJECTS (91473)

Parent: W0000 - CLOSURE BUSINESS UNIT

Switch to Administrative View

**1,177 Total Personnel Assigned on Financial Org Tree for WE0000**

| | | | |
|---|---|---|---|
| WE0000 | **15** LIQUID WASTE DISPOSITION PROJ | **91473** OLSON, LYDEN D. | |
| WE010 | **3** LW DEPUTY | **98848** HAYES, DENNIS L. | |
| WE1000 | **361** H DISPOSITION PROJECT | **95438** DAVIS, WILLIE T. JR | |
| WE2000 | **182** F DISPOSITION PROJECT | **94296** CLARK, WYATT C. JR | |
| WE3000 | **44** EFFLUENT TREATMENT PROJECT | **93253** MCGOVERN, HUGH A. | |
| WE4000 | **76** SALT PROGRAM | **91467** DICKERT, VIRGINIA G. | |
| WE5000 | **64** TANK CLOSURE PREP PROJECT | **92443** HAUER, KIM A. | |
| WE6000 | **16** WASTE ON WHEELS PROJECT | **92291** DAVIS, NEIL R. | |
| WEA000 | **86** AREA MAINT PROJ SERVICES | **92727** GUILHERME, JOEL B. | |
| WEB000 | **133** SAFETY & HEALTH PROJECT SERV | **91465** PADEZANIN, THEODORE III | |
| WEC000 | **70** LW AREA TECH PROJ SERVICES | **91961** LITTLE, DAVID B. | |
| WED000 | **90** LW AREA SUPP PROJ SERVICES | **96585** MCCARTY, LOUIS E. | |
| WEE000 | **37** LIQUID WASTE CONTROLS | **92931** IMMONEN, BRUCE M. | |
| WETEMP | **0** LW ORGS TO BE CLOSED | **91264** MORAN, M. HOLT | ShRINE |

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## WE1000 - H DISPOSITION PROJECT (95438)

Parent: WE0000 - LIQUID WASTE DISPOSITION PROJECTS

Switch to Administrative View

**361 Total Personnel Assigned on Financial Org Tree for WE1000**

| | | |
|---|---|---|
| WE1000 | **8** H DISPOSITION PROJECT | **95438** DAVIS, WILLIE T. JR |
| + WE1100 | **170** HTF OPERATIONS | **92658** VICK, FRANK D. |
| + WE1200 | **20** HTF SUPPORT | **98845** ROBINSON, JEFFREY L. |
| WE1300 | **16** WORK MANAGEMENT CENTER | **92408** BRANDT, PHILLIP R. |
| + WE1400 | **103** HTF MAINTENANCE | **92620** OKAWA, STEVE Y. |
| + WE1500 | **44** HTF ENGINEERING | **96241** BARNES, WILLIAM M. |

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## WE2000 - F DISPOSITION PROJECT (94296)

Parent: WE0000 - LIQUID WASTE DISPOSITION PROJECTS

Switch to Administrative View

**182 Total Personnel Assigned on Financial Org Tree for WE2000**

| | | | |
|---|---|---|---|
| WE2000 | **7** F DISPOSITION PROJECT | **94296** | CLARK, WYATT C. JR |
| WE2100 | **88** FTF OPERATIONS | **92646** | SALMON, RONNIE R. |
| WE2200 | **12** FTF SUPPORT | **95571** | COLEMAN, DAVID H. |
| WE2300 | **2** WORK MANAGEMENT CENTER | **92635** | JACKSON, LARRY R. |
| WE2400 | **59** FTF MAINTENANCE | **92602** | WELLS, ANTHONY T. |
| WE2500 | **14** FTF ENGINEERING | **91435** | TISLER, ANDREW J. |

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## WEC000 - LW AREA TECHNICAL PROJECT SERVICES (91961)

Parent: WE0000 - LIQUID WASTE DISPOSITION PROJECTS

Switch to Administrative View

**70 Total Personnel Assigned on Financial Org Tree for WEC000**

| | | | |
|---|---|---|---|
| WEC000 | **4** LW AREA TECH PROJ SERVICES | **91961** | LITTLE, DAVID B. |
| WEC100 | **0** LW TRANSFER ENGR | **91213** | ARTHUR, GREGORY C. |
| WEC200 | **0** 830 DSA IMPLEMENTATION | **96239** | ORTNER, TERRY L. |
| WEC300 | **26** H&F TF DESIGN AUTHORITY | **91958** | LOIBL, MARC W. |
| WEC500 | **18** H&F PROCESS SUPPORT | **91684** | FREED, ERIC J. |
| WEC800 | **22** LW DMM DESIGN ENGINEERING | **93074** | MARTIN, THOMAS M. |

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## WEC500 - H&F PROCESS SUPPORT (91684)

Parent: WEC000 - LW AREA TECHNICAL PROJECT SERVICES

Switch to Administrative View

**18 Total Personnel Assigned on Financial Org Tree for WEC500**

| | | | |
|---|---|---|---|
| WEC500 | 3 H&F PROCESS SUPPORT | **91684** | FREED, ERIC J. |
| WEC510 | 10 WASTE CHARACTERIZATION COG ENG | **91957** | MARTIN, DAVID J. |
| WEC520 | 5 PROCESS SUPPORT | **91140** | BUMGARDNER, DOUGLAS C. |

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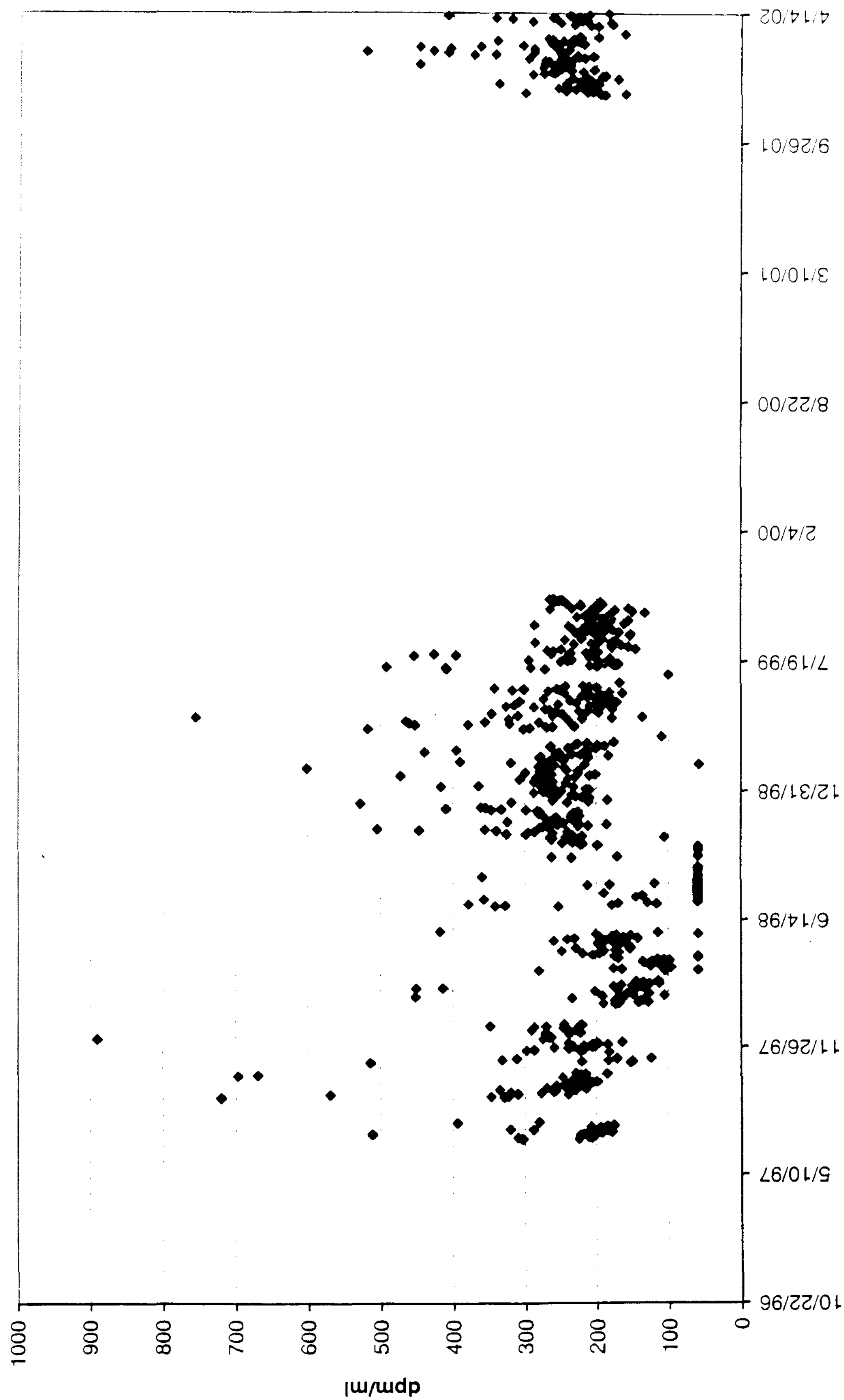
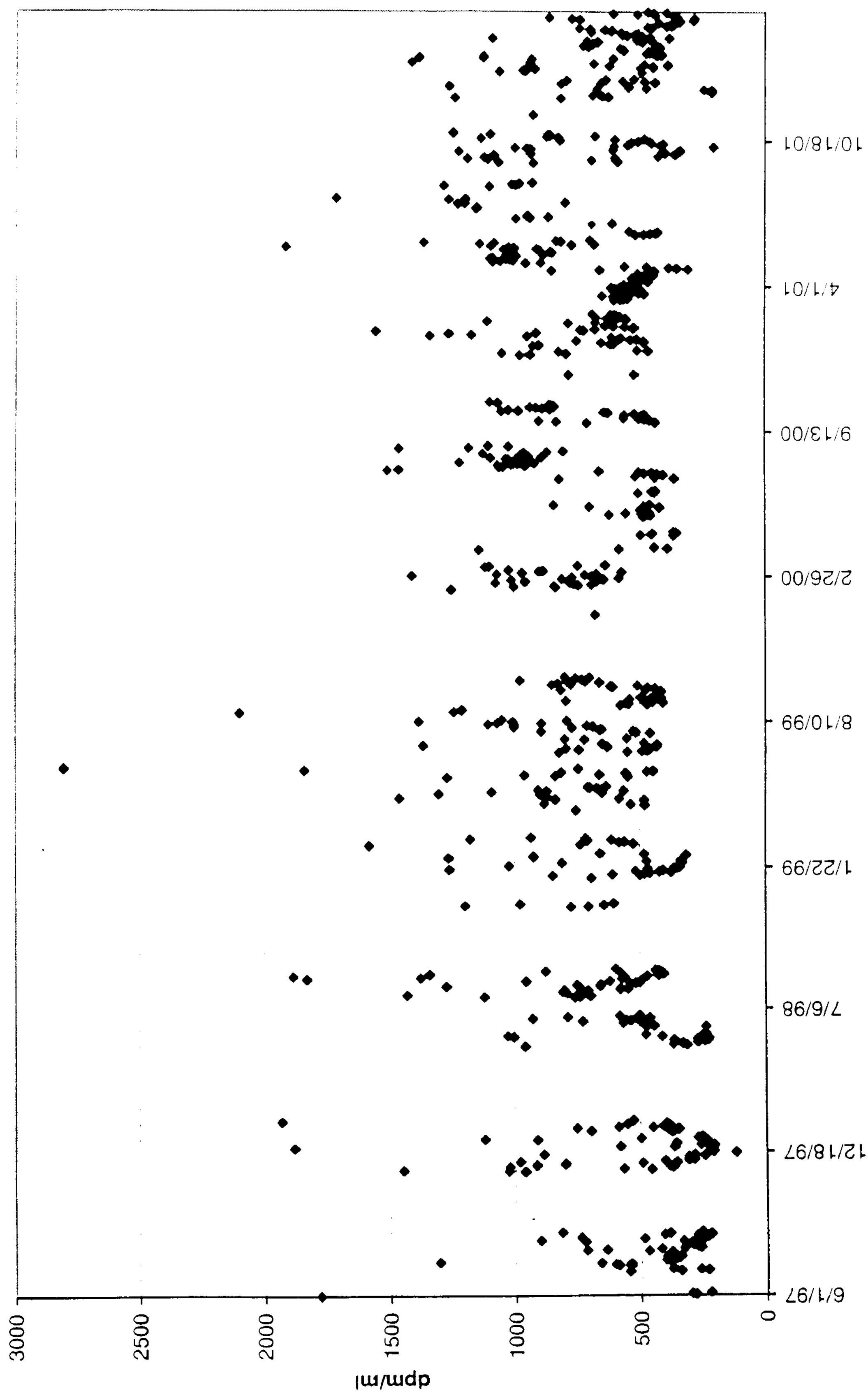
## Evaporator(s) Overheads Activity

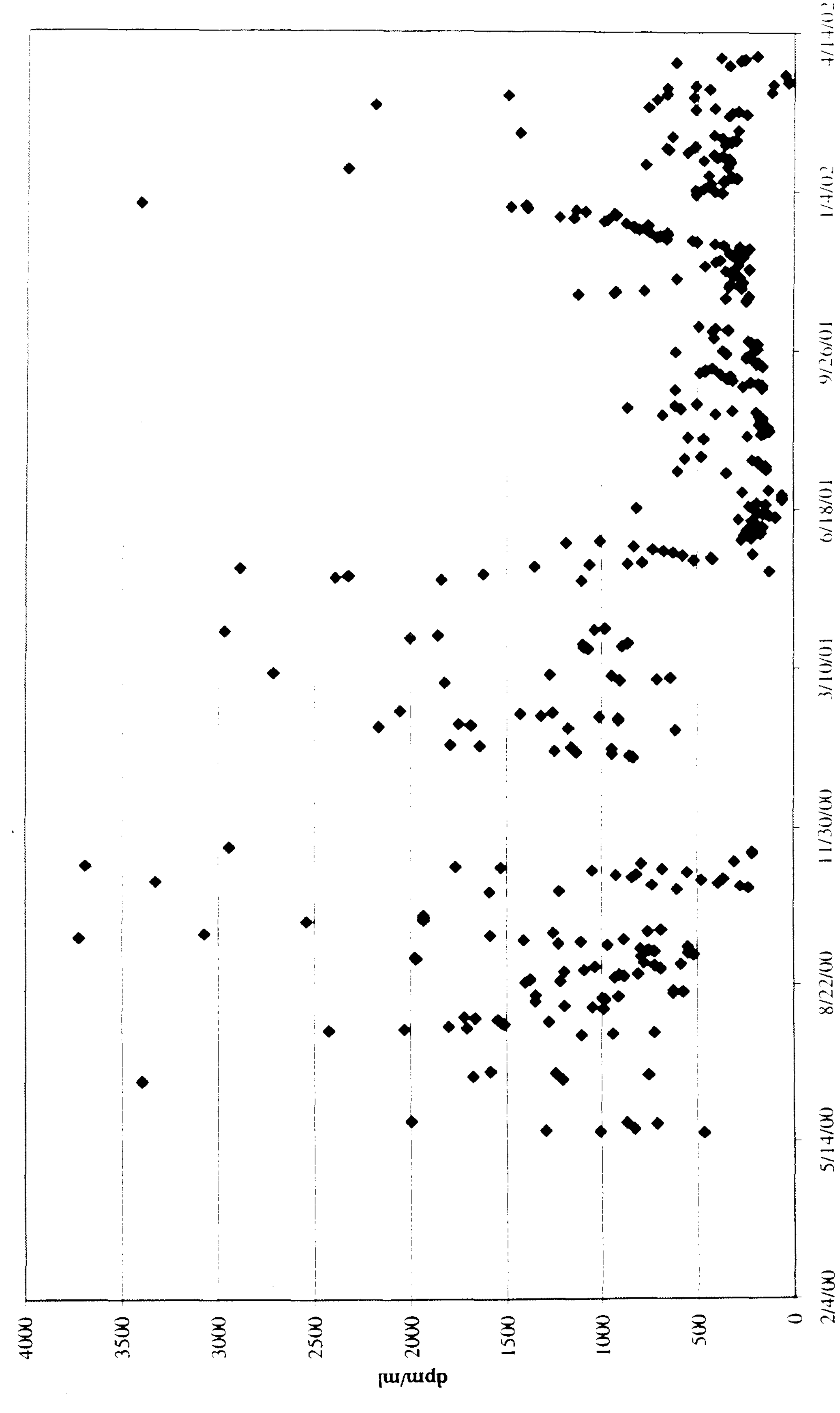
## Attachment 2 – 242-16H Evaporator Overheads Activity



**Attachment 3 – 242-16F Evaporator Overheads Activity**



Attachment 4 – 242-25H Evaporator Overheads Activity



## 5 REFERENCES

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2) WSRC 1S Savannah River Site Waste Acceptance Criteria Manual, Procedure WAC 4.02 F/H Effluent Treatment Facility Waste Acceptance Criteria

3) DPST-73-446, Waste Evaporator Design Changes for Improving De-Entrainment, R. F. Bradley, September 26, 1973

4) Waste Management Evaporator Systems Reference Manual, May 1987

5) WER-WMT-920087, Waste Management High Level Liquid Waste – WMT Recommendations for RHLWE Overheads Cesium Removal, M. A. Ceravolo, February 5, 1992

6) WSRC-TR-94-0442, High-Level Waste System Process Interface Description, P. D. d'Entremont et al., Rev. 1, March 1995

7) WSRC-TR-98-00014, Rev.0, Implications of Organic Constituents and Ammonia on tank Farm Flammability Controls, M. E. Jamison, February 2, 1998

8) Tank Chemistry Data (electronic data included as part of the Waste Characterization System)

9) WSRC-SA-2002-00007, Rev. 2, Concentration, Storage, and Transfer Facilities Documented Safety Analysis, December 2003.

10) WSRC-TR-2003-00526, Analyses of F and H-Tank Farm Evaporator Overheads Samples – 2003, R. F. Swingle & A. L. Williams, December 17, 2003.

11) WSRC-TR-97-0062, Rev.0, Vapor Phase Ammonia Concentrations in Equilibrium with Alkaline Salt Solutions, D. T. Hobbs, February 27, 1997

12) X-SD-G-00001, Rev.14, Waste Acceptance Criteria for High Level Liquid Waste Transfers to the 241-F/H Tank Farms, June 2003

13) Same as Reference 10

14) WSRC- TR-94-029, Assessment of Fission Product Content of High Level Liquid Waste Supernate on E-Area Vault Package Criteria, Rev.0, D. F. Brown, June 30, 1994

15) WSRC-TR-94-0427, Rev. 0, Waste Characterization for the Effluent Treatment Facility in Support of Waste Certification, D. F. Brown, September 7, 1994

16) SW9.1-SW(1H), (2H), (28H), 242-1H, -2H, -28H Storm Water System Manual

17) Catch Tank Sample Analysis Card (located in Building 242 1-H)