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Aluminum Wash and Leach Factors

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Abstract: This report estimates aluminum wash and leach factors using a waste type modeling approach. The model produces reasonable aluminum wash-leach factor predictions that can be used in the Hanford Tank Waste Operations Simulator model.

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EXECUTIVE SUMMARY

Aluminum is an important glass-limiting component in Hanford tank waste. The aluminum wash and leach factors have a significant effect on the volume of HLW glass produced from this waste. Currently, there are two models being used to estimate the wash and caustic leach factors, including the SOWRT model developed from tank fill records and the cluster analysis model derived from cluster analysis tank groups. These models are often unreliable because they either over-estimate the amount of aluminum leached out of the waste (SOWRT model) or do not correlate well with the experimental data (cluster analysis model) for specific tank wastes. This report develops a new model that uses best basis inventory waste types and analytical data to predict aluminum wash-leach values for unanalyzed tanks. Aluminum wash and leach factors are provided for all single-shell and double-shell tanks.

The waste type models provide a good fit between the measured and predicted wash and leach factors for most tanks in the current database. Figure ES-1 shows a comparison between the waste type aluminum wash factor model and the data from the 52 SSTs and 8 DSTs used to develop the model. The linear regression coefficient of determination (R^2) for this set was 0.90, indicating a good correlation with the training set data.

Figure ES-2 shows a comparison between the waste type aluminum leach factor model and the data from the 32 SSTs and 2 DSTs used to develop the model. The R^2 for this data was 0.79, a reasonable correlation with the training set data.

The waste type models provide a good fit with the experimental wash factor data for most tanks, and should produce reasonable predictions for the non-analyzed tanks. The model also produced reasonable leach factor predictions for tanks with waste types that had aluminum leach data. Waste types BYSltCk, AR, A1SltCk, T1SltCk, MW, PL2, R1-boiling, and S1SltCk-nonboiling had no aluminum caustic leach measurements, and average leach factors for saltcake and sludge wastes were assigned to tanks containing these waste types. The CWR waste type was analyzed, but had a best fit leach factor of 2.0, a physical impossibility. Future analytical efforts should be focused on these nine waste types. While the waste type models are not perfect, the accuracy of these models could be further evaluated by comparing predictions with any new data that become available.

Figure ES-1. Aluminum Wash Factor Waste Type Model Comparison with Training Set Data.

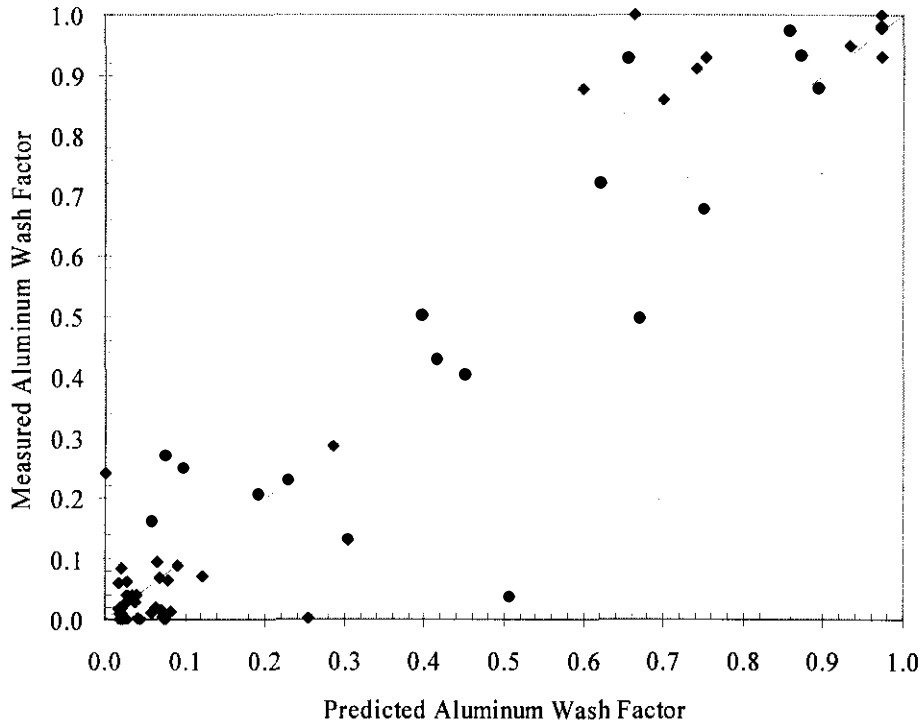
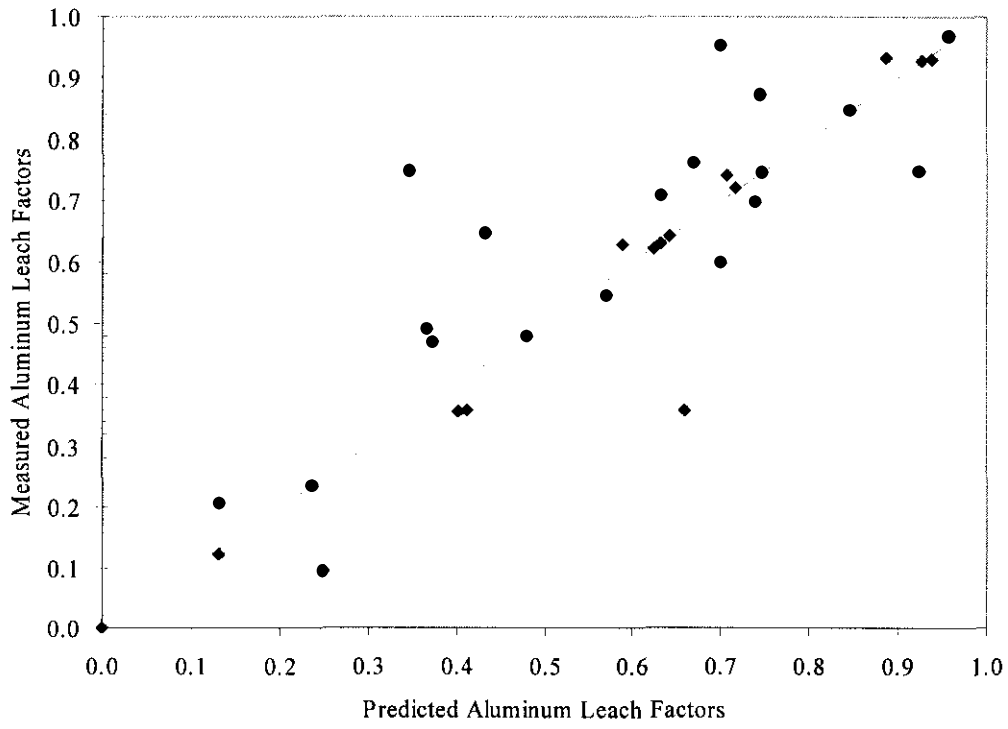


Figure ES-2. Aluminum Leach Factor Waste Type Model Comparison with Training Set Data.



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TERMS

DST	double-shell tank
ESP	Environmental Simulation Program
HDW	Hanford defined waste
HLW	high-level waste
HTWOS	Hanford Tank Waste Operations Simulator
ITS	in-tank solidification
LANL	Los Alamos National Laboratory
N/A	not applicable
ORNL	Oak Ridge National Laboratory
PNNL	Pacific Northwest National Laboratory
PUREX	plutonium-uranium extraction
REDOX	reduction and oxidation
SORWT	Sort on Radioactive Waste Type
SST	single-shell tank
TBP	tributyl phosphate
TWRS	Tank Waste Remediation System
WTP	Waste Treatment Plant

LIST OF WASTE TYPE TERMS

Waste type definitions used in the following discussion are summarized below. These terms are consistent with the terms used in the Hanford defined waste model.

Waste Type	Definition
1C	$BiPO_4$ First cycle decontamination waste (1944-1956)
2C	$BiPO_4$ Second cycle decontamination waste (1944-1956)
224	Lanthanum fluoride process "224 Building" waste (1952-1956)
1CFeCN	Ferrocyanide sludge from in-farm scavenging of 1C supernatants in TY-Farm (1955-1958)
A1SltCk	Saltcake from the first 242-A Evaporator campaign (1977-1980), same as SMMA1
A2SltSlr	Saltcake from the second 242-A Evaporator campaign (1981-1994).
AR	Washed Plutonium-Uranium Extraction (PUREX) sludge (1967-1976)
B	High-level acid waste from PUREX processed at B Plant for Sr recovery (1967-1972)
BL	Low-level waste from B Plant Sr and Cs recovery operations (1967-1976)
BSltCk	Saltcake from 242-B Evaporator operation (1951-1953)
BYSltCk	Saltcake from in-tank solidification (ITS) in BY-Farm (1965-1974)
CEM	Portland Cement, added only to tank 241-BY-105
CSR	Cesium recovery, supernatant from which Cs has been removed
CWP1	PUREX cladding waste (1956-1960)
CWP2	PUREX cladding waste (1961-1972)
CWR1	REDOX cladding waste, aluminum clad fuel (1952-1960)
CWR2	REDOX cladding waste, aluminum clad fuel (1961-1972)
CWZr	Zirconium cladding waste (PUREX and REDOX).
DW	Decontamination waste, primarily from T Plant
HS	Hot semi-works ^{90}Sr recovery waste (1962-1967)
MW	BiPO4 process metal waste (1944-1956)
OWW3	PUREX organic wash waste (1968-1972)
P1	PUREX high-level waste (1956-1962)
P2	PUREX high-level waste (1963-1967)
P2'	PUREX acid waste to B Plant (1964-1972)
P3	PUREX high-level waste (1983-1988)

LIST OF WASTE TYPE TERMS (Continued)

Waste Type	Definition
PFeCN1	Ferrocyanide sludge from in-plant scavenged supernatant (1954-1955)
PFeCN2	Ferrocyanide sludge from in-plant scavenged supernatant (1955-1958)
PL2	PUREX waste from 1983-1988 Campaign
R1	REDOX high-level waste (1952-1958)
R2	REDOX high-level waste (1959-1966)
RSltCk	Saltcake from self-concentration in S- and SX-Farms (1952-1966)
S1SltCk	Saltcake from the first 242-S Evaporator campaign using 241-S-102 feed tank (1973-1976), same as SMMS1
S2SltSlr	Saltcake from the second 242-S Evaporator campaign using 241-S-102 feed tank (1976-1980), same as SMMS2
SRR	HLW transfers during later B-Plant operations, including solids centrifuged from PAS feed, Sr purification waste and WESF or cell drainage with HLW activity.
T1SltCk	Saltcake from the first 242-T Evaporator campaign using 241-TX-118 feed tank (1951-1955)
T2SltCk	Saltcake from the second 242-T Evaporator campaign using 241-TX-118 feed tank (1965-1976)
TFeCN	Ferrocyanide sludge produced by in-tank or in-farm scavenging.
TBP	Tributyl phosphate waste from solvent based uranium recovery operations.
TH	PUREX waste from processing of thoria targets.
Z	Z Plant waste.

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This report estimates aluminum wash and caustic leach factors for Hanford Site single-shell tank (SST) and double-shell tank (DST) wastes. The models presented here combine the existing wash and caustic leach factors data with waste types and estimated aluminum inventories to predict wash-leach factors for the 149 SSTs and 28 DSTs. These models are designed to fit the experimental data for those tanks where such data are available and generate a consistent and reliable set of estimates for the other tanks at the Hanford Site. The wash-leach factors developed here will replace the values currently used in the Hanford Tank Waste Operations Simulator (HTWOS) model.

1.2 BACKGROUND

The best-basis aluminum inventory is about 7,920 MT, with 5,950 MT in the 149 SSTs and 1,970 MT in the DSTs. Most of the aluminum is associated with the solids, with the SSTs holding 5,940 MT of aluminum in the SST solids and the DSTs holding 763 MT. About 15.4 percent of the aluminum is retained in SST and DST supernatants. It is anticipated that the high-level waste feed will be treated with caustic to remove glass-limiting components such as aluminum, chromium, and phosphate. Water digestion and wash factor data are available for 52 SSTs and 8 DSTs, and caustic leaching data for 32 SSTs and 2 DSTs. Because similar data are not available for all tanks, the overall effectiveness of pretreatment must be determined from models that provide estimates of the wash and leach factors for the non-analyzed tanks.

The aluminum wash factor is defined as the amount of aluminum in the water wash solution divided by the total amount of aluminum in the unwashed solids. The aluminum leach factor is defined as the amount of aluminum in the caustic leach solution divided by the total amount of aluminum in the water-washed solids. Sometimes, the leach data also include aluminum that was washed out of the solids or the combined results from washing and leaching of the waste solids. If this is the case, the combined wash and leach data can be converted into leach data by subtracting the wash factor from the combined leach data and dividing the result by 1 - wash factor.

The HTWOS model uses two different caustic leach factors for aluminum, the SORWT model and the cluster analysis model. The SORWT model uses waste analyte mass multipliers to allocate the experimental data from a few tanks to a much larger group of tanks in each SORWT group. The cluster analysis model uses cluster analysis statistical techniques to group tanks and mass weighted averaging of the data to develop tank-specific wash and leach factors for the tanks in each group.

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2.0 ASSUMPTIONS

Several key assumptions were necessary to produce the waste type aluminum wash and leach factor models in this report:

- Each waste type produces a unique set of wash and caustic leach factors and provides similar wash and leach factors in all of the tanks that contain this waste type

- Wash and leach factors vary in direct proportion to the amount of each waste type and the mass fraction of aluminum in each waste type (in other words, the tank data can be broken down into a linear contribution from different waste types, in direct proportion to the aluminum mass of each waste)

- Waste types can be further divided into waste sub-types based on waste processing history and chemistry.

- Aluminum wash-leach factor variability is about the same for the saltcake and sludge wastes and this data can be pooled for the statistical analysis.

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3.0 METHOD OF ANALYSIS

3.1 SORT ON RADIOACTIVE WASTE TYPE MODEL

The first wash and leach model for aluminum and other components in the waste was developed in 1997. This model was derived from the available wash and leach data using the SORWT model, as described in PNL-9814, *The Sort on Radioactive Waste Type Model: A Method to Sort Single-Shell Tanks into Characteristic Groups*, to group tanks with similar wastes. Results were extrapolated to the non analyzed tanks as described in PNNL-11646, *Status Report: Pretreatment Chemistry Evaluation FY 1997-Water Wash and Caustic Leach Factors for the Single-Shell Tank Waste Inventory*. The grouping method used in the SORWT model consists of a qualitative assessment of the tanks that received similar primary and secondary wastes based on the transaction information in WHC-MR-0132, *A History of the 200 Area Tank Farms*. The SORWT model was used to arrange the SSTs into 24 different groups, each with similar chemical and physical characteristics based on their major waste types and processing histories. These groups encompass 133 of the 149 SSTs and 93 percent of the total waste in the SSTs. Sixteen SSTs did not meet the established sorting criteria and were assigned to a separate group (group XXV). Statistical methods were then used, including an analysis of variance from core sample data since 1989, to show that five of the SST groups identified by the SORWT model (SORWT groups IV, VII, XII, XV, and XVI) are statistically significant.

SORWT groups were derived from a qualitative assessment of tank fill records, and, as such, are of only limited value for the best-basis inventory. This need is currently being fulfilled by the Hanford Defined Waste (HDW) model, which is derived from a much more comprehensive set of records, including the waste transaction files, fuel records, process flowsheets, essential materials records, tank samples, density and void fraction estimates, and the solubility limits for the main analytes in the waste. The HDW model uses these data to account for the main chemicals and radionuclides in the waste and to determine the waste types and volumes and compositions of each waste in the tanks.

SORWT group tanks do not necessarily contain the same wastes and/or the same proportions of those wastes. For example, SORWT groups VII, XI, XIV, XV, and XVIII have nearly identical wastes, while all of the other groups have a wide variety of different wastes and/or waste compositions. SORWT groups were arranged to represent four major waste groups ($BiPO_4$, tributyl phosphate [TBP], reduction and oxidation [REDOX], and plutonium-uranium extraction [PUREX]), with the wash and leach results from key tanks being used to estimate the average wash and leach performance of all tanks in the group based on a mass weighted multiplier.

The REDOX waste is especially important in this model because this waste represents 64 percent of total aluminum inventory, 43 percent of the aluminum washed out of the solids, and 74 percent of the aluminum leached out of the solids from all SSTs (PNNL-11646). The REDOX wastes were subdivided into four different groups, each represented by a different set of tanks. These subgroups are listed in Table 3-1, together with the values used to assess the wash and leach factors for aluminum in REDOX waste. Based on this approach, the average wash and leach factors for aluminum are 0.24 and 0.78, respectively. Table 3-2 provides a comparison of the estimated amount of aluminum in the REDOX subgroup tanks using the SORWT model and

the best-basis inventory for the same tanks. This comparison is useful because it shows that the SORWT method tends to over-predict the total amount of aluminum in the REDOX tanks (4,066 MT versus 3,130 MT from the best-basis inventory), and based on the same multipliers, also over-estimates the amount of aluminum leached out of many of the S and SX farm tanks. Table 3-3 compares the measured and SORWT model wash and leach factors for aluminum.

The measured wash factors for tanks 241-S-101, 241-S-104, 241-S-107, 241-S-109, 241-S-111, 241-SX-103, and 241-SX-108 are based on the core composite and core segment water digestion and fusion digestion data, while the leach factors are based on analytical data adjusted to the 8-hour caustic leaching process specified for the WTP. The SORWT model wash and leach factors are the measured values that were available in 1997. The measured wash-leach values for individual tanks vary significantly and are different than those used in the SORWT model to estimate the average wash and leach factors for aluminum in the REDOX waste tanks. These differences have led to an over prediction in the SORWT. The SORWT model average wash factor for all SSTs is about 44 percent too low, while the caustic leach factor is 45 percent too high compared to the waste type models.

Table 3-1. Reduction and Oxidation Subgroups and Parameters for Assessing the Water Wash and Caustic Leach Factors for Aluminum.

REDOX Tanks	Tank waste volume (kL)	Tank Al inventory (MT)	REDOX subgroup waste volume (kL)	Waste volume multiplier	Estimated subgroup Al inventory (MT)
241-S-101/241-S-111/ 241-S-109/241-SX-102/ 241-SX-103	9,663	528.3	52,647	5.45	2,880
241-S-107	1,420	240	1,420	1	240
241-SX-113	98	1.6	560	5.71	9.13
241-S-104/241-SX-108	1,438	249.75	5,396	3.75	936.5
Total	12,619	1,020	60,023	--	4,066

*PNNL-11646, *Status Report: Pretreatment Chemistry Evaluation FY 1997-Water Wash and Caustic Leach Factors for the Single-Shell Tank Waste Inventory.*

REDOX = reduction and oxidation.

Table 3-2. Reduction and Oxidation Subgroups, Sort on Radioactive Waste Type Groups, and Estimated Aluminum Inventory from Sort on Radioactive Waste Type Model and Best-Basis Inventory.

REDOX subgroup tanks	SORWT groups in each REDOX subgroup	Tank Al inventory, MT	Waste volume multiplier	Estimated subgroup Al inventory from SORWT model, MT	Subgroup Al inventory from best-basis inventory, MT
241-S-101/241-S-111/ 241-S-109/241-SX-102/ 241-SX-103	I, V, IX, and 241-TX-108	528.3	5.45	2,880	2,119
241-S-107	241-S-107	240	1	240	119
241-SX-113	XXIV	1.6	5.71	9.21	2.28
241-S-104/241-SX-108	IV, XVIII, and tanks 241-T-101, 241-TX-101, and 241-U-204	249.8	3.75	936.5	890.2
Total	--	1,020	--	4,066	3,130

REDOX = reduction and oxidation.
SORWT = Sort on Radioactive Waste Type

Table 3-3. Comparison of Measured versus Sort on Radioactive Waste Type Model Wash and Leach Factors for Aluminum.

Tanks	Wash factors		Leach factors	
	Measured wash factor	SORWT model wash factor	Estimated (8-hour) leach factor	SORWT model (maximum) leach factor
241-S-101	0.494	0.12	0.36	0.98
241-S-104	0.12	0.03	0.47	0.987
241-S-107	0.089	0	0.71	0.65
241-S-109	0.728	0.894	--	--
241-S-111	0.721	0.1	0.4	0.98
241-SX-102	NR	0.884	--	--
241-SX-103	0.208	0.995	--	--
241-SX-108	0.163	0.06	0.23	0.38
241-SX-113	0	0.01	0.64	0.878

NR = not reported.
SORWT = Sort on Radioactive Waste Type.

3.2 CLUSTER ANALYSIS MODEL

A second model was developed in 1999 to estimate tank-specific wash and leach factors for a large number of components, including aluminum, in the Hanford Site tank wastes (HNF-3157, *Best-Basis Water Wash and Caustic Leach Factor Analysis*). This model used cluster analysis techniques to group tanks based on the relative concentration of 19 key analytes as described in a 1998 PNNL letter report (*Transmission of Deliverable 5.2C of the Statement of Work for Historic Data and Model Confidence Evaluation Covered Under 1N4GG30C)*. The key analytes used in this analysis are listed in Table 3-4. Tank groupings were heavily influenced by the analytes that were present at the highest concentrations, Al, Na, and PO_4. This effort produced 21 different tank groups that were used, together with the available wash and leach data, mass average weighing techniques, and chemical analogues, to generate wash and leach factor estimates for a large number of analytes in the SSTs and DSTs.

Table 3-4. Key Analytes Used in Cluster Group Analysis

Al	Bi	Ca	Cr
137Cs	Fe	F	La
Mn	Ni	P as PO_4	90Sr
U	NO_2	TIC as CO3	Pb
Zr	Si	Na	

Tank-specific estimates were preferentially based on the experimental data, with data from the tank characterization database, historical samples, process aids, ESP modeling, cluster analysis group averages and all tank group averages being used in descending order of priority. In this model, the wash and leach factor estimates for most tanks are based on the tank group average, with these averages being used to represent the wash factors for 60% of the SSTs and DSTs and caustic leach factors for 77% of the SSTs and DSTs. Estimates for the remaining tanks are based on the experimental data and ESP, with the results frequently being averaged to incorporate all of the data within a 25% relative standard deviation (RSD). Other criteria were also used to screen out the outliers (values exceeding 25% RSD) or to select the preferred data as referenced in the appendix of HNF-3157. The cluster analysis tanks groups are listed in Appendix B, together with the best-basis aluminum inventory, predicted wash and leach factors, and best-basis inventory waste types in each tank.

Cluster groups 1, 3, 6, 8, 12 and 20 consist of single tanks (one tank in each group), while cluster group 5 lists tanks with mostly 224 waste. Group 7 is comprised of tanks with CWZr2 (zirconium coating) waste, while group 21 consists of tanks with HS (hot semi-works) waste. All other cluster groups, including groups 2, 4, 9, 10, 11, 13, 14, 15, 16, 17, 18 and 19, consists of tanks with a broad range of unrelated wastes (see appendix B). In most of these groups, the sludge and saltcake wastes are treated as a composite blend for purposes of estimating the mass weighted group average for all of the tanks in each group not represented by tank-specific data.

The cluster analysis model assumes that tanks with similar waste compositions (based mostly on 3 of 19 key analytes) also have related wash and leach factors. This approach is appealing because it provides a convenient way to extrapolate data from only a few tanks to a much larger

number of tanks in each cluster group. The model assumes that the component source and its history in the tank farm have no impact on the component's form in the waste. Basic chemical principles dictate that the form will usually determine the component's partitioning between liquids and solids, in other words, the wash and leach factors for that component.

Table 3-5 illustrates the wide variety of wastes associated with some of the cluster analysis groups. In addition to obvious differences in the solids, several of the cluster groups also include supernatant-laden wastes from the AP and AN farms (cluster groups 10 and 19).

Table 3-5. Cluster Analysis Groups and Corresponding Best-Basis Inventory Waste Types.

Group	Best-Basis Inventory Waste Types
10	B, A2SltSlr, P3, BYSltCk, 1C, TFeCN, PFeCN
13	CWP, TBP, TFeCN, 1C
14	1C, TBP, CWP, R, CWR, 2C, 1CFeCN
15	A1SltCk, SRR, AR, BSltCk, 1C, 2C, BYSltCk, CWP, TBP, 1CFeCN, T2SltCk
16	CWP, TBP, AR, OWW, S1SltCk, RSltCk, R, CWR, 1C
17	P2, A2SltSlr, TBP, 1C, BYSltCk, PFeCN, S1SltCk, S2SltSlr, T1SltCk, T2SltCk, CWR, R
18	A1SltCk, A2SltSlr, BSltCk, S1SltCk, RSltCk, R, S2SltSlr
19	A1SltCk, A2SltSlr, CWP, P3, S1SltCk, S2SltSlr

The cluster analysis model appears to generate unsatisfactory predictions for some tanks. Figure 3-1 shows a plot of the measured versus predicted aluminum wash factors. The linear regression coefficient of determination for this fit is 0.68.

A similar fit between the measured versus predicted leach factors is shown in Figure 4-2. The coefficient of determination for the best-fit line through the origin is about 0.28, a poor correlation between the measured and predicted leach factors. Two tanks help drive this poor correlation, 241-AN-104 (100% A2SltSlr) that had a predicted value of 0.99 but a measured value of zero, and 241-B-101 (7.6% B, 29.7% BL, and 62.7% BSltCk) that had a predicted value of zero and a measured value of 0.46. Excluding these two tanks, the coefficient of determination would be a much improved 0.46.

Figure 3-1. Measured Versus Predicted Cluster Analysis Aluminum Water Wash Factors.

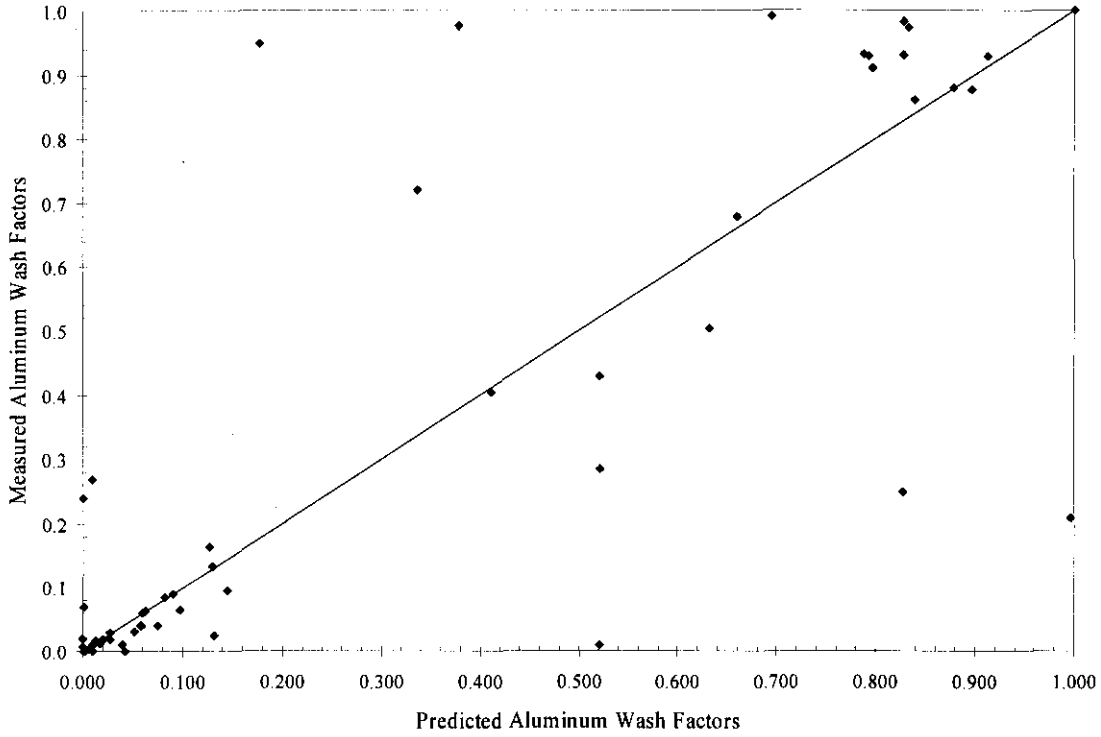
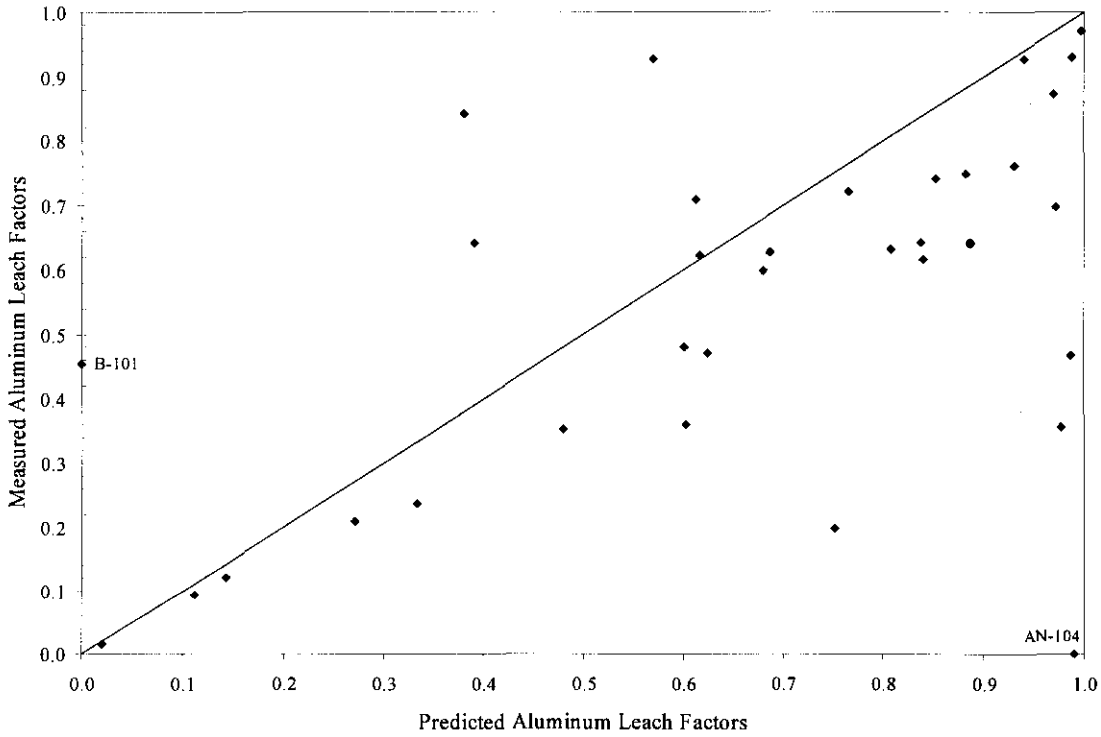


Figure 3-2. Measured Versus Predicted Cluster Analysis Aluminum Caustic Leach Factors.



3.3 WASTE TYPE MODEL

The aluminum wash-leach factor for any tank waste is the sum of the factors for each waste type multiplied by its corresponding aluminum mass fraction. This can be stated mathematically as

$$TWF_i = \sum_{j=1}^{k_i} p_j F_j \tag{3-1}$$

Where TWF_i = mean Tank Waste Factor for tank i, either wash or leach
j waste type
k_i = number of waste types in tank i
p_j = mass fraction of waste type j in tank i
F_j = wash factor or leach factor for waste type j in tank i

It is possible to predict wash-leach factors for non-analyzed tank wastes if the waste type volume fractions (p_j) and corresponding wash-leach factors (F_j) are known. Waste sampling, characterization, and transfer data have been used to establish best-basis inventories for all 149 SSTs and 28 DSTs at the Hanford Site. The best basis inventory predicts waste types and waste type volumes. The best basis waste types and waste volumes used in this report are summarized in Appendix A and are further described in LAUR 96-3860, *Hanford Tank Chemical and Radionuclide Inventories: HDW Model Rev. 4* and RPP-8847, *Best-Basis Inventory Template Compositions of Common Tank Waste Layers.*

Wash-leach factors have now been measured for many tanks (i.e., TWF_i); however, tanks are rarely comprised of a single waste type so it necessary to know the waste type wash-leach factors (i.e., F_j) to extrapolate the results from analyzed to unanalyzed tanks. Rearranging Equation 3-1, the wash or leach factor for a specific waste type is the following:

$$F_j^* = \frac{TWF_i - \sum_{\substack{j=1 \\ j \neq *}}^{k_i} p_j F_j}{p_j^*} \tag{3-2}$$

Where $*$ = specific waste type
F_j^* = wash or leach factor for the specific waste type
p_j^* = aluminum mass fraction of the specific waste type

The waste type wash-leach factors can be solved for by linear regression. That is, using the best basis inventories for mass fractions (p_j), assign the corresponding waste type wash-leach factor (F_j) such that the tank waste wash-leach factor calculated using Equation 3-1 is as close a fit as possible with measured tank waste wash-leach factor. The software used for the linear regression is discussed in Section 5.0.

4.0 INPUT DATA

4.1 ALUMINUM CHEMISTRY

Sodium aluminate [$Na^+Al(OH)_4^-$] is the only form of dissolved aluminum in the interstitial liquid, as described in Gale, J. D. et al., 1998, *Theoretical Investigation of the Nature of Aluminum-Containing Species Present in Alkaline Solutions*. There are, however, at least six different forms of insoluble aluminum that could precipitate from a saturated sodium aluminate solution, including amorphous, microcrystalline, bayerite, doyleite, nordstrandite and gibbsite. These precipitates all have the same general composition [$Al(OH)_3$], but with different structures and solubilities. In the absence of seed crystals, any of these forms could precipitate from a saturated sodium aluminate solution, depending on the temperature and composition of the solution. The crystallization process for gibbsite is very slow, only a few micrometers per hour. For this reason, large quantities of gibbsite "seed" crystals are usually needed to produce acceptable yields in a reasonable amount of time.

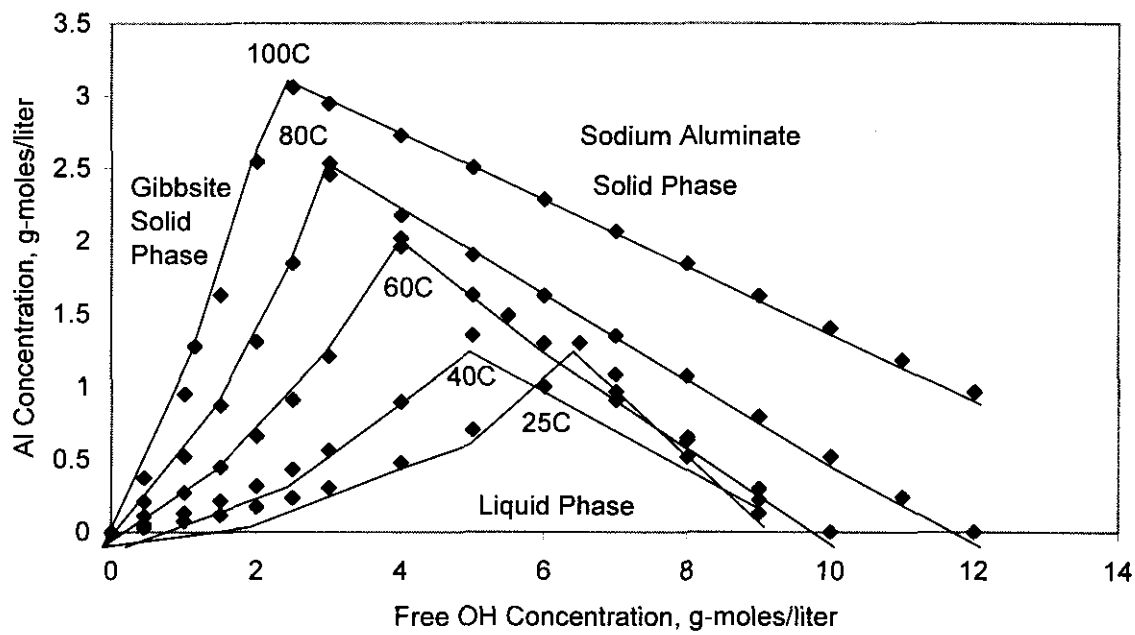
Activated alumina is a general expression for partially dehydrated transition phases alumina (such as bayerite, doyleite, nordstrandite and gibbsite). These transition phases are usually created by heating bayerite or by attempting to rehydrate a crystalline form such as gibbsite. The amorphous form is highly soluble, but with time and temperature, could be gradually converted into less soluble and more crystalline forms such as bayerite, nordstrandite or gibbsite. Gibbsite is the most crystalline and thermodynamically stable form of $Al(OH)_3$. This form is usually produced by adding seed crystals to a hot, saturated sodium aluminate solution, but can also be slowly formed by bubbling CO_2 through the solution at 50 to 60 °C. In addition to the transition phases that have been described, gibbsite also can be thermally dehydrated to boehmite [AlOOH], one of the most insoluble forms of aluminum hydroxide. This conversion is slow at temperatures below 100 °C, but is 85% complete within 6 to 10 hours at 150 °C (a temperature commonly reached in the sludge layers in the boiling tanks), as described in Russell et al. (1955), *Solubility and Density of Hydrated Aluminas in NaOH Solutions*.

The gibbsite and sodium aluminate solubility limits are shown as a function of temperature in Figure 4-1. This plot is based on the waste feed compositions expected in the WTP. The HTWOS model was used to predict, on a batch-by-batch basis, the nitrate and nitrite concentrations before the caustic addition step in the WTP. While the specific compositions are highly variable, the average concentration is 1.5 moles/liter nitrate and 0.3 moles per liter nitrite. These values were used together with experimental models for gibbsite [$Al(OH)_3$] and sodium aluminate [$NaAl(OH)_4$] to generate the solubility curves in Figure 4-1. The gibbsite solubility model is described in Russell et al.(1955), while the sodium aluminate model is discussed in RHO-RE-ST-14P (1984), *Solubilities of Sodium Nitrate, Sodium Nitrite and Sodium Aluminate in Simulated Nuclear Waste*.

The gibbsite and sodium aluminate solubility curves intersect at a common free hydroxide concentration. This intersection point defines the boundary between the gibbsite and sodium aluminate phases. Because the crystallization process is very slow, it is important to ensure that these solutions have stabilized before the final analytical measurements are taken. The gibbsite solubility data were generated by partially dissolving gibbsite in various sodium hydroxide solutions and equilibrating these solutions at various temperatures over a period of several

weeks, as described in Russell et al. (1955). The solids were characterized afterwards and found to be consistent with the known composition of gibbsite. The sodium aluminate data was developed by dissolving a known amount of material in various sodium hydroxide solutions and measuring the equilibrium concentrations as a function of temperature after about a month, as described in RHO-RE-ST-14P (1984). Intermediate measurements were also taken to ensure that equilibrium conditions had been reached. This study, however, did not characterize the solids in contact with the saturated sodium aluminate solutions.

Figure 4-1. Gibbsite and Sodium Aluminate Solubility Curves as a Function of Temperature Under WTP Conditions (1.5 M NO_3 and 0.3 M NO_2).



The general equation for dissolving gibbsite in a (sodium) hydroxide solution is shown below. This step consumes one mole of free hydroxide for each mole of gibbsite that dissolves.

$$Al(OH)_3\,(solid) + OH^- = AlO_2^-\,(solution) + 2H_2O \qquad (4\text{-}1)$$

According to Russell, the equilibrium constant for this reaction is:

$$K = C_{AlO2^-} * A_{H2O}^2 / C_{OH} \qquad (4\text{-}2)$$

Where: $C_{AlO2^-} = AlO_2^-$ concentration, g-moles/liter

C_{OH^-} = OH^- concentration, g-moles/liter. The measured OH^- concentration must be corrected for the aluminate ion.
A_{H2O}^2 = activity of water (squared)

The activity of water is equal to the square of its mole fraction. The mole fraction of water can be determined by dividing the moles of water by the total number of moles, including moles of sodium, aluminate and hydroxide. In figure 4-1, the activity of water was corrected to account for 1.5 M NO_3 and 0.3 M NO_2. The equilibrium constant, K, varies as a function of temperature, as shown by the following equation for gibbsite.

$$K = (-7340/4.574 * T) - 4.11 \quad (4\text{-}3)$$

Where: T = temperature, K

Finally, the density of a sodium hydroxide solution saturated with gibbsite is expressed by the following equation:

$$d = 1.002 + (0.00109 + 5.9E\text{-}06\ T)\ (\text{grams of } Na_2O/\text{liter}) - (T - 25)\ (0.00075) \quad (4\text{-}4)$$

Where: T = temperature, °C

The general equation describing the dissolution of sodium aluminate in a (sodium) hydroxide solution is shown below.

$$NaAlO_2\ (\text{solid}) = Na^+ + AlO_2^-\ (\text{solution}) \quad (4\text{-}5)$$

The sodium aluminate solubility relationship is defined by the following empirical equation:

$$[NaAlO_2] = 5.304 - 0.055T - 0.502[OH] + 0.000413T^2 + 0.00282T[OH] - 0.00189T[NO_3] - 0.00150*T*[NO_2] \quad (4\text{-}6)$$

Where:
$[NaAlO_2]$ = $NaAlO_2$ concentration, in g-moles/liter
[OH] = OH concentration, in g-moles/liter
$[NO_3]$ = NO_3 concentration, in g-moles/liter
$[NO_2]$ = NO_2 concentration, in g-moles/liter
T = temperature, C

The identified limits for this solubility equation are:
T = 60 to 100 °C
[OH] = 2 to 6.5 g-moles/liter
$[NO_3]$ = 1.7 to 5.0 g-moles/liter
$[NO_2]$ = 2.0 to 6.2 g-moles/liter
R^2 = 0.853 (least squares coefficient of determination)

These limits were extended to represent the sodium aluminate solubility curves in Figure 4-1. The [OH] range was extend from 6.5 to 9 M, the $[NO_3]$ range from 2 M to 1.5 M, the $[NO_2]$ range from 1.7 M to 0.3 M and the temperature from 60 to 25 °C to represent the 40 and 25 °C parametric curves. These changes are expected to have very little effect on the sodium aluminate

solubility curves based on the shape of the sodium aluminate solubility surface depicted in Figure 7 of RHO-RE-ST-14P (1984). The 40 and 25 °C parametric curves are also bounded by the 60 °C parametric curve in the sodium aluminate region in Figure 4-1.

Other components were added to the solution to simulate the composition of the waste evaporator feeds at Hanford. These components are listed in Table 4-1.

Table 4-1. Nuclear Waste Background Components

Components	Concentration (moles/liter)
EDTA (tetrasodium salt of EDTA)	0.051
Citrate (trisodium citrate)	0.083
Na_3PO_4	0.07
Na_2CO_3	0.07
Na_2SO_4	0.016

The general equation for dissolving bayerite in a (sodium) hydroxide solution is shown below. This equation is identical to equation 1 and requires one mole of free hydroxide for each mole of bayerite that dissolves.

$$Al(OH)_3\,(solid) + OH^- = AlO_2^-\,(solution) + H_2O \qquad (4\text{-}7)$$

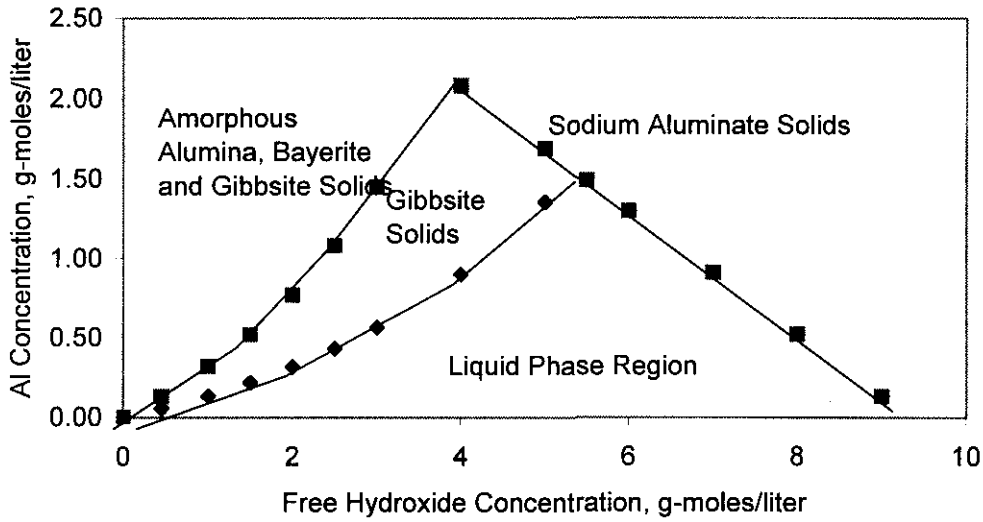
The equilibrium constant, K, varies as a function of temperature, as shown by the following equation for bayerite.

$$K = (-5240/4.574 * T) - 3.01 \qquad (4\text{-}8)$$

Where: T = temperature, K

Figure 4-2 shows the amorphous alumina, bayerite and gibbsite phase regions and sodium aluminate solubility curve at 40 °C. This curves is of interest because it define the region where the amorphous alumina, bayerite and gibbsite solids form as a function of temperature and free hydroxide concentration in the waste. The liquid phase region is defined by the gibbsite and sodium aluminate solubility lines. In the gibbsite region, amorphous alumina and gibbsite are stable solids, while amorphous alumina, bayerite and gibbsite could all precipitate, depending on the crystallization kinetics of each phase, from a saturated solution above the bayerite solubility line in Figure 4-2.

Figure 4-2. Bayerite, Gibbsite and Sodium Aluminate Solubility Curves at 40 °C.



4.2 ALUMINUM WASH FACTORS

4.2.1 Wash Factors Tank Groupings

Table 4-2 provides a list of the best-basis inventory waste types and the waste sub-groups used in this report. From the best basis inventory estimates, 20% of the aluminum is currently bound up with the sludge and 80% with the saltcake solids. The most important wastes not represented by experimental data are CWZr sludge and T1SltCk saltcake. These wastes represent 4.8% and 2.7% of the sludge and saltcake volumes, respectively, but only 0.22% and 0.52% of the total aluminum inventory. As a result, these wastes are expected to have very little impact on the accuracy of the waste type wash factor predictions for most tanks.

Table 4-2. Wash Factor Tank Waste Groupings

Waste Type	Tanks
Sludges	
1C	241-B-104, 241-B-105, 241-B-106, 241-B-107, 241-BX-107, 241-BX-108, 241-BX-110, 241-BX-110, 241-BX-111, 241-BX-112, 241-C-107, 241-C-108, 241-C-109, 241-C-110, 241-C-111,, 241-C-112, 241-T-104, 241-T-105, 241-T-106, 241-T-107, 241-T-108, 241-TX-109, 241-TX-110, 241-TX-111, 241-TX-113, 241-TX-114, 241-U-110, 241-U-111, 241-U-112 (14 of 29 tanks analyzed)
1CFeCN	241-TY-101, 241-TY-103, 241-TY-104 (1 of 3 analyzed)
224	241-B-201, 241-B-202, 241-B-203, 241-B-204, 241-T-110, 241-T-111, 241-T-112, 241-T-201, 241-T-202, 241-T-203, 241-T-204 (4 of 11 analyzed)
2C	241-B-104, 241-B-105, 241-B-110, 241-B-111, 241-B-112, 241-T-105, 241-T-110, 241-T-111, 241-T-112 (5 of 9 analyzed)
AR	241-A-103, 241-A-104, 241-A-106, 241-C-103, 241-C-106 (1 of 5 analyzed)
B	241-B-101 (1 of 1 analyzed)

Table 4-2. Wash Factor Tank Waste Groupings

Waste Type	Tanks
BL	241-AX-102, 241-AY-102, 241-B-101 (2 of 3 analyzed)
CWP	241-AW-102, 241-BX-105, 241-BX-106, 241-B-107, 241-B-108, 241-B-109, 241-BX-101, 241-BX-102, 241-BX-103, 241-BX-104, 241-BY-103, 241-BY-109, 241-C-102, 241-C-103, 241-C-104, 241-C-105, 241-C-107, 241-C-109, 241-C-111, 241-C-112, 241-T-102, 241-T-103, 241-T-107 (12 of 25 analyzed)
CWR	241-BX-104, 241-S-101, 241-S-104, 241-S-107, 241-S-110, 241-S-111, 241-T-101, 241-T-103, 241-T-105, 241-T-106, 241-U-105, 241-U-107, 241-U-108, 241-U-109, 241-U-110, 241-U-112, 241-U-201, 241-U-202, 241-U-203, 241-U-204 (11 of 20 analyzed)
CWZr	241-AW-103, 241-AW-105, 241-C-102, 241-C-104, 241-S-107 (none analyzed)
DE	241-BX-102, 241-SX-113, 241-TX-116, 241-TX-117, 241-TY-106, 241-U-104 (1 of 6 analyzed)
HS	241-C-109, 241-C-111, 241-C-201, 241-C-202, 241-C-203, 241-C-204 (1 of 6 analyzed).
MW	241-B-101, 241-B-103, 241-BX-104, 241-BX-105, 241-BY-112, 241-C-102, 241-T-102, 241-T-103, 241-TX-101, 241-TX-102, 241-TX-105, 241-TX-106, 241-TX-108 (4 of 13 analyzed)
OWW3	241-C-104 (1 of 1 analyzed)
P2	241-A-101, 241-A-104, 241-A-105, 241-AX-103, 241-AX-104, 241-B-110, 241-B-111 (3 of 6 analyzed)
P3	241-AZ-101, 241-AZ-102 (2 of 2 analyzed)
PFeCN	241-BY-104, 241-BY-105, 241-BY-106, 241-BY-107, 241-BY-108, 241-BY-110 (5 of 6 analyzed)
PL2	241-AW-104, 241-AW-105 (none analyzed)
R (boiling)	241-S-101, 241-S-104, 241-S-107, 241-S-110, 241-SX-103, 241-SX-104, 241-SX-107, 241-SX-108, 241-SX-109, 241-SX-110, 241-SX-111, 241-SX-112, 241-SX-113, 241-SX-114, 241-SX-115, 241-U-110 (9 of 16 analyzed)
R (non-boiling)	241-S-102, 241-S-103, 241-S-105, 241-S-108, 241-S-109, 241-S-111, 241-S-112, 241-SX-101, 241-SX-102, 241-SX-105, 241-T-105, 241-TX-101, 241-TX-104, 241-TX-106, 241-U-101, 241-U-102, 241-U-103, 241-U-104, 241-U-111, 241-U-112 (4 of 20 analyzed)
SRR	241-A-106, 241-AX-101, 241-C-107 (2 of 3 analyzed).
TBP	241-B-106, 241-BX-101, 241-BX-103, 241-BX-105, 241-BX-106, 241-BX-108, 241-BX-109, 241-C-101, 241-C-102, 241-C-105, 241-C-108, 241-T-107, 241-TX-108, 241-TX-115, 241-TY-103, 241-TY-104, 241-TY-105, 241-TY-106 (9 of 18 analyzed)
TFeCN	241-BY-101, 241-C-108, 241-C-109, 241-C-111, 241-C-112 (3 of 5 analyzed)
TH	241-C-102, 241-C-104 (2 of 2 analyzed)
Z	241-SY-102, 241-TX-101 (1 of 2 analyzed)
Saltcakes	
A1SktCk	241-A-101, 241-A-102, 241-A-103, 241-A-106, 241-AW-103, 241-AX-101, 241-AX-102, 241-AX-103 (2 of 8 analyzed)
A2SltSlr	241-AN-101, 241-AN-102, 241-AN-103, 241-AN-104, 241-AN-105, 241-AN-107, 241-AP-105, 241-AW-101, 241-AW-104, 241-AW-106 (4 of 9 analyzed)
BSltCk	241-B-101, 241-B-102, 241-B-103, 241-B-104, 241-B-105, 241-B-107, 241-B-108, 241-B-109 (3 of 8 analyzed)

Table 4-2. Wash Factor Tank Waste Groupings

Waste Type	Tanks
BYSltCk	241-B-112, 241-BX-110, 241-BX-111, 241-BY-101, 241-BY-102, 241-BY-103, 241-BY-104, 241-BY-105, 241-BY-106, 241-BY-107, 241-BY-108, 241-BY-109, 241-BY-110, 241-BY-111, 241-BY-112 (5 of 15 analyzed)
RSltCk (boiling)	241-S-101, 241-S-104, 241-SX-103, 241-SX-104, 241-SX-107, 241-SX-109, 241-SX-110, 241-SX-111, 241-SX-112, 241-SX-114 (4 of 10 analyzed)
RSltCk (non-boiling)	241-SX-101, 241-TX-107 (1 of 2 analyzed)
S1SltCk (boiling)	241-S-101, 241-S-107, 241-S-110, 241-SX-103, 241-SX-104 (5 of 5 analyzed)
S1SltCk (non-boiling)	241-S-102, 241-S-103, 241-S-105, 241-S-106, 241-S-108, 241-S-109, 241-S-111, 241-S-112, 241-SX-101, 241-SX-102, 241-SX-105, 241-SX-106, 241-U-103, 241-U-106, 241-U-108, 241-U-109, 241-U-111 (7 of 18 analyzed)
S2SltSlr (SSTs)	241-S-101, 241-S-102, 241-S-103, 241-S-107, 241-SX-101, 241-SX-102, 241-SX-106, , 241-U-102, 241-U-103, 241-U-105, 241-U-107, 241-U-108, 241-U-109, 241-U-111 (7 of 14 analyzed)
S2SltSlr (DSTs)	241-SY-101, 241-SY-103 (1 of 2 analyzed)
T1SltCk	241-T-108, 241-T-109, 241-TX-103, 241-TX-112, 241-TX-114, 241-TX-116, 241-TX-117, 241-TY-101, 241-TY-102 (none analyzed)
T2SltCk	241-S-107, 241-T-101, 241-TX-101, 241-TX-102, 241-TX-103, 241-TX-104, 241-TX-105, 241-TX-106, 241-TX-107, 241-TX-108, 241-TX-110, 241-TX-111, 241-TX-112, 241-TX-113, 241-TX-114, 241-TX-115, 241-TX-116, 241-TX-117, 241-TX-118, 241-TY-102, 241-TY-103, 241-U-102, 241-U-105, 241-U-107 (4 of 24 analyzed)

The R, RSltCk and S1SltCk waste types were divided into boiling tank and non-boiling tank sub-groups, depending on which S and SX farm tanks were represented by the data. These sub-groups were needed to reconcile the data from tanks with similar wastes but with significantly different wash factors. This scatter is believed to be caused by differences in the thermal conditions in the tank (whether the wastes were boiling or not). The temperatures that were generated by radioactive decay are thought to have had a major role in determining the wash and caustic leach factors for the R, RSltCk and S1SltCk wastes in these tanks. While the experimental data was initially used to determine the need for these sub-groups, the criteria for identifying the tanks in each sub-group were actually developed from the waste transaction records and from the temperature data in RHO-CD-1172, *Survey of the Single-Shell Tank Thermal Histories*.

There are sixteen tanks in the S and SX farms that were filled with REDOX wastes and were allowed to boil and self-concentrate. These tanks include 241-S-101, 241-S-104, 241-S-107, 241-S-110, 241-SX-101, 241-SX-103, 241-SX-104, 241-SX-107, 241-SX-108, 241-SX-109, 241-SX-110, 241-SX-111, 241-SX-112, 241-SX-113, 241-SX-114, and 241-SX-115. The boiling tank group also includes tank 241-U-110, which was assigned to this group because of the waste transaction records and thermal history of the tank. All of these tanks were primary receivers of REDOX (R type) waste. The non-boiling tank group consists of tanks that were the secondary (or over-flow cascade receivers) of R, RSltCk, S1SltCk and S2SltSlr wastes, including all of the remaining tanks in the S, SX and U tank farms.

Tank 241-SX-101 was moved from the boiling to the non-boiling group because of the aluminum wash factor for this waste (which is consistent with a high free hydroxide

concentration in this waste). This tank was filled with REDOX waste in 1954, the same year that numerous improvements were being made to the REDOX facility and uncontrolled ruthenium releases were occurring. A substantial amount of excess sodium hydroxide may have been added to this tank from the ruthenium scrubber and because of off-normal operating conditions in this facility. This would have altered the chemistry enough to precipitate sodium aluminate, consistent with the high aluminum wash factor for this waste. Sodium aluminate was recently identified as one of the main components in this waste, as described in HNF-12145, *Saltcake Dissolution FY 2002 Status Report.*

The most important tanks with CWZr waste are 241-AW-103 and 241-AW-105. T1SltCk samples have been obtained from a number of tanks (241-T-108, 241-T-109, 241-TX-116 and 241-TY-102), but these samples have never been analyzed to estimate the effective wash factors for this waste. According to the sample inventory logs, several archive samples may still be available from tanks 241-T-108 (jars 7428, 7429) and 241-T-109 (jars 7659, 7462 and 7660). Samples from 241-T-109 would be especially valuable as this tank only contains T1SltCk waste.

4.2.2 Wash Data

Aluminum wash data are currently available for 54 SSTs and 7 DSTs. These data were obtained from a variety of sources, including core composite and core segment water wash data in the tank characterization database; experimental wash data from various studies; and from saltcake dissolution studies performed at the Hanford Site (see Appendix A). Wash factor data for aluminum are summarized in Tables 4-3 and 4-4. The data for 241-T-105 was not used in wash model development because it was a core segment sample and could not be confidently tied to a specific waste type.

Table 4-3. Aluminum Wash Factor Data for Single-Shell Tank Waste.

Tank	Core Composite Wash Factor[1]	Core segment Wash Factor[2]	Wash Factor from Experiments	Experiment Reference	Saltcake Dissolution Wash factor[3]
241-A-101	0.879	--	--	--	0.979
241-AX-101	0.948	1.0	--	--	--
241-B-101	--	--	0.25	PNNL-12026	--
241-B-104	--	--	0.06	LAUR 96-2839	--
241-B-106	0.063	0.077	--	--	0
241-B-108	0.011	0.030	--	--	--
241-B-110	0.020	--	0.25	PNL-9387	--
241-B-111	0.008	--	0.06	PNL-10712	--
241-B-201	0.017	--	0.28	PNL-10078	--
241-B-202	0.018	--	--	--	--
241-BX-103	--	--	0.27	LAUR97-2889	--
241-BX-105	--	--	0.0164	LAUR95-2070	--
241-BX-107	0.009	--	0.01	PNL-10712	--
241-BX-109	0.095	--	0.03	LAUR96-2839	--
241-BX-110	--	--	0.037	PNNL-12026	--
241-BX-112	0.018	0.034	0.044	PNNL-12026	--
241-BY-102	--	--	--	--	0.72
241-BY-104	--	0.910	0.61	PNNL-11278	--
241-BY-106	1.000	--	--	--	0.982
241-BY-107	0.928	0.933	--	--	--

Table 4-3. Aluminum Wash Factor Data for Single-Shell Tank Waste.

Tank	Core Composite Wash Factor[1]	Core segment Wash Factor[2]	Wash Factor from Experiments	Experiment Reference	Saltcake Dissolution Wash factor[3]
241-BY-110	0.860	0.851	0.65	PNNL-11278	--
241-C-102	--	--	0.004	PNNL-12026	
241-C-103	--	--	0	PNL-10712	--
241-C-104	0.012	--	0.093	LAUR97-2889	--
241-C-105	--	--	0	LAUR97-2889	--
241-C-107	--	--	0	PNNL-11278	--
241-C-108			0.03	LAUR 95-2070	--
241-C-109	0.002	--	0	PNL-9387	--
241-C-110	0.084	--	--	--	--
241-C-112	0.031	0.007	0.34	PNL-9387	--
241-S-101	0.133	--	0.11	PNNL-11636	--
241-S-102	0.932	0.658	--	--	0.9
241-S-104	0.040	--	--	--	--
241-S-107	0.065	0.105	--	--	--
241-S-109	--	0.928	--	--	--
241-S-110	0.070	0.086	--	--	--
241-S-111	0.499	--	0.02	PNNL-11636	--
241-SX-101	0.974	--	--	--	--
241-SX-103	0.208	--	--	--	--
241-SX-108	--	0.163	0.09	PNNL-11278	--
241-SX-113	--	--	0	LAUR 97-2889	--
241-T-102	0.003	--	--	--	--
241-T-104	0.010	--	--	--	--
241-T-105	--	0.003	--	--	--
241-T-107	0.040	--	0	LAUR-95-2070	--
241-T-110	--	--	0	PNNL-13956	--
241-T-111	0.019	--	0	PNL-10712--	--
241-TX-113	0.428	0.759	--	--	0.34
241-TX-118	0.285	0.070	--	--	--
241-TY-104	--	--	0.04	LAUR 96-2839	--
241-U-105	--	0.404	--	--	--
241-U-106	0.679	--	--	--	--
241-U-108	0.877	--	--	--	--
241-U-109	0.503	0.688	--	--	--
241-U-110	0.020	--	0.01	PNL-10078	--

Notes: [1] Derived by comparing the average aluminum removed by water digestion against the total aluminum results from fusion digestion analyses in the tank characterization database core composite data.

[2] Derived by comparing the average aluminum removed by water digestion against the total aluminum results from fusion digestion analyses in the tank characterization database core segment data.

[3] HNF-3437, *Saltcake Dissolution FY 1998 Status Report*; HNF-5193, *Saltcake Dissolution FY 1999 Status Report*; HNF-7031, *Saltcake Dissolution FY 2000 Status Report*; and HNF-8849, *Saltcake Dissolution FY 2001 Status Report*.

Table 4-4. Aluminum Wash Factor Data for Double-Shell Tank Waste.

Tank	Core composite water wash factor[1]	Core segment water wash factor[2]	PNNL water wash factor	Saltcake dissolution water wash factor[3]
241-AN-103	--	--	--	0.983
241-AN-104	--	--	0.99	1.000
241-AN-105	--	--	--	0.977
241-AW-101	--	--	--	0.93
241-AY-102	--	0.069	--	--
241-AZ-102	--	--	0.025[4]	--
241-SY-102			0.229	
241-SY-103	--	--	0.09	--

Notes: [1] Derived by comparing the average aluminum removed by water digestion against the total aluminum results from fusion digestion analyses in the tank characterization database core composite data.

[2] Derived by comparing the average aluminum removed by water digestion against the total aluminum results from fusion digestion analyses in the tank characterization database core segment data.

[3] HNF-3437, *Saltcake Dissolution FY 1998 Status Report*; HNF-5193, *Saltcake Dissolution FY 1999 Status Report*; HNF-7031, *Saltcake Dissolution FY 2000 Status Report*; and HNF-8849, *Saltcake Dissolution FY 2001 Status Report*.

[4] BNFL-RPT-038, 2000, *Characterization Washing, Leaching, and Filtration of AZ-102 Sludge*, Pacific Northwest National Laboratory, Richland, Washington.

[5] Letter from S. Lindberg (LATA) to D. J. Washenfelder (WHC), September 30, 1996, Task B: Final Draft of the revised *Solubility Factors and Ranges Letter Report* under WHC Contract TJJ-SBW-38770, Los Alamos Technical Associates, Richland Washington.

4.3 ALUMINUM LEACH FACTORS

4.3.1 Leach Factors Tank Groupings

Table 4-5 provides a list of the best-basis inventory waste types and the waste sub-groups used for the leach factor tank groupings. Rationale for the sub-groupings is the same at that developed for the wash factor sub-groupings.

4.3.2 Leach Data

Caustic leach data were obtained from various PNNL, LANL, and ORNL studies based on the maximum amount of aluminum leached out of the waste. The caustic leach factors for aluminum are frequently published as combined wash and leach factors. If this was the case, the experimental results were converted into simple leach factors by subtracting the wash factor from the combined leach data and dividing the result by (1-wash factor).

The WTP is currently designed for only an 8-hour caustic leaching process (8 hours with 3 molar NaOH at 80 to 100 °C). Caustic leaching studies have been performed at various concentrations and temperatures, and for times ranging from 4 to more than 200 hours. These results show that less aluminum is likely to be leached out of the waste with only 8 hours of contact time. Aluminum leach factor data are summarized in Table 4-6. This data was used to estimate the equivalent 8-hour caustic leach factors using linear interpolation. Linear interpolation of the data is reasonable because almost all of the gibbsite dissolves in 3-5 hours while the remaining boehmite dissolves so slowly that the rate is essentially constant. Multiple measurements were

available for some tanks, and in these cases the data were averaged. The shaded entries represent actual measurements at 8 hours and no interpolation was necessary.

Table 4-5. Leach Factor Tank Waste Groupings

Waste Type	Tanks
Sludges	
1C	241-B-104, 241-B-105, 241-B-106, 241-B-107, 241-BX-107, 241-BX-108, 241-BX-110, 241-BX-110, 241-BX-111, 241-BX-112, 241-C-107, 241-C-108, 241-C-109, 241-C-110, 241-C-111, 241-C-112, 241-T-104, 241-T-105, 241-T-106, 241-T-107, 241-T-108, 241-TX-109, 241-TX-110, 241-TX-111, 241-TX-113, 241-TX-114, 241-U-110, 241-U-111, 241-U-112 (12 of 29 tanks analyzed)
1CFeCN	241-TY-101, 241-TY-103, 241-TY-104 (1 of 3 analyzed)
224	241-B-201, 241-B-202, 241-B-203, 241-B-204, 241-T-110, 241-T-111, 241-T-112, 241-T-201, 241-T-202, 241-T-203, 241-T-204 (4 of 11 analyzed)
2C	241-B-104, 241-B-105, 241-B-110, 241-B-111, 241-B-112, 241-T-105, 241-T-110, 241-T-111, 241-T-112 (4 of 9 analyzed)
AR	241-A-103, 241-A-104, 241-A-106, 241-C-103, 241-C-106 (1 of 5 analyzed)
B	241-B-101 (1 of 1 analyzed)
BL	241-AX-102, 241-AY-102, 241-B-101 (1 of 3 analyzed)
CWP	241-AW-102, 241-BX-105, 241-BX-106, 241-B-107, 241-B-108, 241-B-109, 241-BX-101, 241-BX-102, 241-BX-103, 241-BX-104, 241-BY-103, 241-BY-109, 241-C-102, 241-C-103, 241-C-104, 241-C-105, 241-C-107, 241-C-109, 241-C-111, 241-C-112, 241-T-102, 241-T-103, 241-T-107 (9 of 25 analyzed)
CWR	241-BX-104, 241-S-101, 241-S-104, 241-S-107, 241-S-110, 241-S-111, 241-T-101, 241-T-103, 241-T-105, 241-T-106, 241-U-105, 241-U-107, 241-U-108, 241-U-109, 241-U-110, 241-U-112, 241-U-201, 241-U-202, 241-U-203, 241-U-204 (7 of 20 analyzed)
CWZr	241-AW-103, 241-AW-105, 241-C-102, 241-C-104, 241-S-107 (none analyzed)
DE	241-BX-102, 241-SX-113, 241-TX-116, 241-TX-117, 241-TY-106, 241-U-104 (1 of 6 analyzed)
HS	241-C-109, 241-C-111, 241-C-201, 241-C-202, 241-C-203, 241-C-204 (1 of 6 analyzed).
MW	241-B-101, 241-B-103, 241-BX-104, 241-BX-105, 241-BY-112, 241-C-102, 241-T-102, 241-T-103, 241-TX-101, 241-TX-102, 241-TX-105, 241-TX-106, 241-TX-108 (3 of 13 analyzed)
OWW3	241-C-104 (1 of 1 analyzed)
P2	241-A-101, 241-A-104, 241-A-105, 241-AX-103, 241-AX-104, 241-B-110, 241-B-111 (1 of 6 analyzed)
P3	241-AZ-101, 241-AZ-102 (2 of 2 analyzed)
PFeCN	241-BY-104, 241-BY-105, 241-BY-106, 241-BY-107, 241-BY-108, 241-BY-110 (2 of 6 analyzed)
PL2	241-AW-104, 241-AW-105 (none analyzed)
R (boiling)	241-S-101, 241-S-104, 241-S-107, 241-S-110, 241-SX-103, 241-SX-104, 241-SX-107, 241-SX-108, 241-SX-109, 241-SX-110, 241-SX-111, 241-SX-112, 241-SX-113, 241-SX-114, 241-SX-115, 241-U-110 (7 of 16 analyzed)
R (non-boiling)	241-S-102, 241-S-103, 241-S-105, 241-S-108, 241-S-109, 241-S-111, 241-S-112, 241-SX-101, 241-SX-102, 241-SX-105, 241-T-105, 241-TX-101, 241-TX-104, 241-TX-106, 241-U-101, 241-U-102, 241-U-103, 241-U-104, 241-U-111, 241-U-112 (1 of 20 analyzed)
SRR	241-A-106, 241-AX-101, 241-C-107 (1 of 3 analyzed).

Table 4-5. Leach Factor Tank Waste Groupings

Waste Type	Tanks
TBP	241-B-106, 241-BX-101, 241-BX-103, 241-BX-105, 241-BX-106, 241-BX-108, 241-BX-109, 241-C-101, 241-C-102, 241-C-105, 241-C-108, 241-T-107, 241-TX-108, 241-TX-115, 241-TY-103, 241-TY-104, 241-TY-105, 241-TY-106 (8 of 18 analyzed)
TFeCN	241-BY-101, 241-C-108, 241-C-109, 241-C-111, 241-C-112 (3 of 5 analyzed)
TH	241-C-102, 241-C-104 (2 of 2 analyzed)
Z	241-SY-102, 241-TX-101 (none analyzed).
Saltcakes	
A1SktCk	241-A-101, 241-A-102, 241-A-103, 241-A-106, 241-AW-103, 241-AX-101, 241-AX-102, 241-AX-103 (none analyzed)
A2SltSlr	241-AN-101, 241-AN-102, 241-AN-103, 241-AN-104, 241-AN-105, 241-AN-107, 241-AP-105, 241-AW-101, 241-AW-104, 241-AW-106 (1 of 9 analyzed)
BSltCk	241-B-101, 241-B-102, 241-B-103, 241-B-104, 241-B-105, 241-B-107, 241-B-108, 241-B-109 (2 of 8 analyzed)
BYSltCk	241-B-112, 241-BX-110, 241-BX-111, 241-BY-101, 241-BY-102, 241-BY-103, 241-BY-104, 241-BY-105, 241-BY-106, 241-BY-107, 241-BY-108, 241-BY-109, 241-BY-110, 241-BY-111, 241-BY-112 (3 of 15 analyzed)
RSltCk (boiling)	241-S-101, 241-S-104, 241-SX-103, 241-SX-104, 241-SX-107, 241-SX-109, 241-SX-110, 241-SX-111, 241-SX-112, 241-SX-114 (2 of 10 analyzed)
RSltCk (non-boiling)	241-SX-101, 241-TX-107 (none analyzed)
S1SltCk (boiling)	241-S-101, 241-S-107, 241-S-110, 241-SX-103, 241-SX-104 (2 of 5 analyzed)
S1SltCk (non-boiling)	241-S-102, 241-S-103, 241-S-105, 241-S-106, 241-S-108, 241-S-109, 241-S-111, 241-S-112, 241-SX-101, 241-SX-102, 241-SX-105, 241-SX-106, 241-U-103, 241-U-106, 241-U-108, 241-U-109, 241-U-111 (2 of 18 analyzed)
S2SltSlr	241-S-101, 241-S-102, 241-S-103, 241-S-107, 241-SX-101, 241-SX-102, 241-SX-106, 241-SY-101, 241-SY-103, 241-U-102, 241-U-103, 241-U-105, 241-U-107, 241-U-108, 241-U-109, 241-U-111 (4 of 16 analyzed)
T1SltCk	241-T-108, 241-T-109, 241-TX-103, 241-TX-112, 241-TX-114, 241-TX-116, 241-TX-117, 241-TY-101, 241-TY-102 (none analyzed)
T2SltCk	241-S-107, 241-T-101, 241-TX-101, 241-TX-102, 241-TX-103, 241-TX-104, 241-TX-105, 241-TX-106, 241-TX-107, 241-TX-108, 241-TX-110, 241-TX-111, 241-TX-112, 241-TX-113, 241-TX-114, 241-TX-115, 241-TX-116, 241-TX-117, 241-TX-118, 241-TY-102, 241-TY-103, 241-U-102, 241-U-105, 241-U-107 (none analyzed)

Table 4-6. Aluminum Caustic Leach Factor Data as a Function of Time.

Tanks	Reference	Chemical	Temp (°C)	5 hrs	8 hrs Estimated	10 hrs	24 hrs	72 hrs	100 hrs	140 hrs	168 hrs
241-AN-104	PNNL-11636	3 M NaOH	100	--	0.0	0	--	--	--	--	--
241-AZ-102	BNFL-RPT-038	3 M NaOH	80	--	0.628	--	0.71	--	--	--	--
241-B-101	PNNL-12026	3 M NaOH	100	0.45	0.455	--	0.48	0.45	--	--	0.49
241-B-104	LAUR 96-2839	3 M NaOH	100	0	0.360	0.6	--	--	--	--	--
241-B-106	LAUR 97-2889	3 M NaOH	100	0.64	0.742	0.81	--	--	--	--	--
241-B-110	PNL-9387	3 M NaOH	100	--	--	0.26	--	--	--	--	--
241-B-111	PNL-10712	3 M NaOH	100	0.01	0.016	0.02	--	--	--	--	--
241-B-201	PNL-10078	3 M NaOH	100	--	0.208	0.26	0.3	--	--	--	--
241-B-202	LAUR 95-2070	3 M NaOH	100	0.05	0.122	0.17	--	--	--	--	--
241-BX-103	LAUR 97-2889	3 M NaOH	100	0.93	0.970	0.997	--	--	--	--	--
241-BX-105	LAUR 95-2070	3 M NaOH	100	0.62	0.848	0.99	--	--	--	--	--
241-BX-107	PNL-10712	3 M NaOH	100	0.48	0.600	0.68	--	--	--	--	--
241-BX-109	LAUR 96-2839	3 M NaOH	100	0.35	0.698	0.93	--	--	--	--	--
241-BX-110	PNNL-12026	3 M NaOH	95	0.92	0.933	--	0.97	0.98	--	--	0.99
241-BX-112	PNNL-12026	3 M NaOH	100	0.65	0.593	--	0.6	0.58	--	--	0.59
241-BY-104	PNNL-11278	3 M NaOH	100	0.91	0.928	0.94	--	--	--	--	--
241-BY-108	PNNL-11636	3 M NaOH	100	--	--	0.22	--	--	--	--	--
241-BY-110	PNNL-11278	3 M NaOH	100	0.33	0.33	0.33	--	--	--	--	--
241-C-102	PNNL-12026	3 M NaOH	100	0.74	0.749	--	--	0.94	--	--	--
241-C-103	PNL-10712	3 M NaOH	100	0.16	0.352	0.48	--	--	--	--	--
241-C-104	LAUR 97-2889	3 M NaOH	100	0.73	0.874	0.97	--	--	--	--	--
241-C-105	LAUR 97-2889	3 M NaOH	100	0.84	0.930	0.99	--	--	--	--	--
241-C-107	TWRS Bench scale	3 M NaOH	100	0.38	--	0.62	--	--	--	--	--
241-C-107	LAUR 96-2839	3 M NaOH	100	0.47	--	0.75	--	--	--	--	--
241-C-107	PNNL-11278	3 M NaOH	100	0.64	0.623[1]	0.78	--	--	--	--	--

Table 4-6. Aluminum Caustic Leach Factor Data as a Function of Time.

Tanks	Reference	Chemical	Temp (°C)	5 hrs	8 hrs Estimated	10 hrs	24 hrs	72 hrs	100 hrs	140 hrs	168 hrs
241-C-108	LAUR 95-2070	3 M NaOH	100	0.51	0.762	0.93	--	--	--	--	--
241-C-109	PNL-9387	3 M NaOH	100	--	0.632	0.79	--	--	--	--	--
241-C-112	PNL-9387	3 M NaOH	100	--	0.547	0.77[2]	--	--	--	--	--
241-S-101	PNNL-12026	3 M NaOH	95	0.3	0.357	--	0.66	0.72	--	--	0.9
241-S-104	PNNL-11636	3 M NaOH	100	0.45	0.469	--	--	0.99	--	--	0.99
241-S-107	PNNL-11278	3 M NaOH	100	0.52	0.71	--	--	--	--	--	--
241-S-110	PNNL-13702	3 M NaOH	100	0.34	0.49	--	0.76	0.97	--	--	1
241-S-111	PNNL-11636	3 M NaOH	100	--	0.36	--	--	--	--	0.53	--
241-SX-108	PNNL-11278	3 M NaOH	100	0.23	0.236	0.24	--	--	--	--	--
241-SX-113	LAUR 97-2889	3 M NaOH	100	0.27	0.642	0.89	--	--	--	--	--
241-SY-103	PNL-10712	3 M NaOH	100	0.53	0.746	0.89	--	--	--	--	--
241-T-104	PNL-10712	3 M NaOH	100	0.24	--	0.62	--	--	--	--	--
241-T-104	LAUR 95-2070	3 M NaOH	100	0.39	0.474[3]	0.63	--	--	--	--	--
241-T-107	LAUR 95-2070	3 M NaOH	100	0.65	0.722	0.77	--	--	--	--	--
241-T-110	PNNL-13956	3 M NaOH	100	0.69	0.75	--	0.75	--	--	--	0.75
241-T-111	PNL-10712	3 M NaOH	100	0.04	0.094	0.13	--	--	--	--	--
241-TY-104	LAUR 96-2839	3 M NaOH	100	0.3	0.480	0.6	--	--	--	--	--
241-U-110	PNL-10078	3 M NaOH	100	0.36	0.648	0.84	--	--	--	--	--

Notes: [1] Average for the three 241-C-107 tests.

[2] Leach test was actually 11.3 hrs instead of 10 hrs.

[3] Average for the two 241-T-104 tests.

Aluminum leach factor results are currently available for 32 SSTs and 2 DSTs. These data were obtained from a variety of sources, including caustic leach data from various studies. The caustic leach study results are summarized in the Appendix A. The aluminum leach factors in Table 4-8 were used to estimate the equivalent 8-hour leach factors for these tanks. These estimates were used, together with the waste type compositions in each tank, to construct leach factor estimates for all of the remaining SSTs and DSTs.

When the leach factor data were analyzed, including the pedigree of the samples and the conditions used for the caustic leaching studies, several data were not usable. The leach factor data appears to be suspect for tanks 241-BY-110, 241-C-103, and 241-C-104. The 241-BY-110 leach data was not used because most of the aluminum was solubilized during water washing (about 94%) and little was solubilized (about 2% of the original total aluminum) during caustic leaching. The leach factor calculation requires calculating the small difference between two large numbers [i.e., (0.96-0.94)/(1-0.94)]), which makes extrapolation unreliable. Tank 241-C-103 data was not used because insufficient hydroxide was used in the test and the data is biased (PNL-10712). Results from 241-C-104 were not used because it could not be determined what waste type(s) the samples represented.

The 241-BY-104 sample is assumed to only represent the PFeCN sludge in the tank because the aluminum content after washing is almost all from the PFeCN waste (99.8%). The BYSltCk waste type (0.2%) is not adequately represented to make a reliable prediction for this waste type.

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5.0 USE OF COMPUTER SOFTWARE

Statistical software (JMP™, The Statistical Discovery Software, English Edition, Professional Edition, Version 5) was used to estimate waste type wash-leach factors by linear regression and to estimate uncertainties. Further discussion on how the software was used is provided in Appendix C.

JMP™ results were verified by replicating the calculation using S-Plus™, Version 6.0 statistical software. Identical input data were used and the outputs from the two statistical software applications are shown side-by-side in Appendix C. Results were identical.

™ JMP is a business unit of SAS (Statistical Analysis Software), and is a registered trademark of the SAS Institute Inc., SAS Campus Drive, Cary, NC 27513.

™ S-Plus is a registered trademark of Insightful, 1700 Westlake Avenue North, Suite 500, Seattle, WA 98109

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6.0 RESULTS

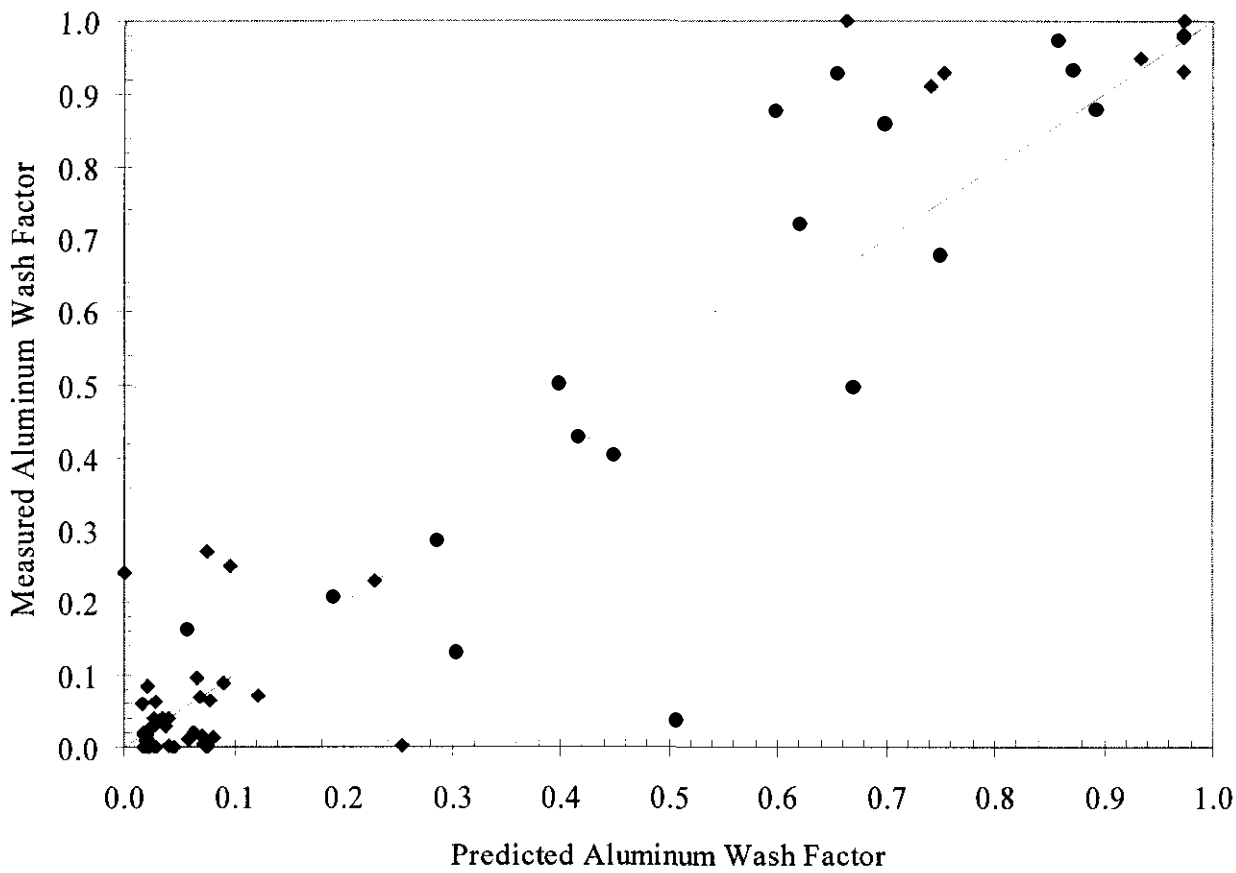
This section presents results for aluminum wash-leach factors based on the input data and analyses in Chapter 4.0. Calculation details and input data for Figures 6-1 and 6-2 are presented in Appendix C.

6.1 ALUMINUM WATER WASH FACTORS AND UNCERTAINTIES

6.1.1 Wash Factor Model Comparison Against Training Set Data

Figure 6-1 shows a plot of the measured versus predicted wash factors using the waste type model for 52 SSTs and 8 DSTs. This data represents the training set that was used to develop the model. The linear regression coefficient of determination (R^2) for this set is 0.90, which indicates a good correlation between the measured and predicted wash factors for these tanks.

Figure 6-1. Aluminum Wash Factor Model Comparison With Training Set Data.



6.1.2 Wash Factor Predictions for All Tanks

Table 6-1 presents the wash factors for all 149 SSTs and 28 DSTs. Shaded values are measured and the nonshaded are predicted based on the waste type model. Included in Table 6-1 are uncertainty estimates (RSDs) for the wash factors.

Table 6-1. Aluminum Wash Factor Means and Uncertainties.

Tank	Wash Factor	RSD[1], (%)	Tank	Wash Factor	RSD, (%)
Single-Shell Tanks					
241-A-101	0.879	11	241-S-110	0.070	60
241-A-102	0.934	11	241-S-111	0.499	15
241-A-103	0.933	11	241-S-112	0.751	14
241-A-104	0.000	*	241-SX-101	0.974	†
241-A-105	0.023	624	241-SX-102	0.771	†
241-A-106	0.344	†	241-SX-103	0.208	†
241-AX-101	0.948	11	241-SX-104	0.133	†
241-AX-102	0.572	15	241-SX-105	0.752	12
241-AX-103	0.815	11	241-SX-106	0.955	†
241-AX-104	0.023	624	241-SX-107	0.054	†
241-B-101	0.250	†	241-SX-108	0.163	196
241-B-102	0.000	*	241-SX-109	0.021	†
241-B-103	0.000	*	241-SX-110	0.038	†
241-B-104	0.016	†	241-SX-111	0.048	†
241-B-105	0.000	*	241-SX-112	0.051	†
241-B-106	0.063	189	241-SX-113	0.000	*
241-B-107	0.018	†	241-SX-114	0.027	†
241-B-108	0.011	†	241-SX-115	0.058	196
241-B-109	0.065	†	241-T-101	0.152	113
241-B-110	0.020	433	241-T-102	0.003	109
241-B-111	0.008	385	241-T-103	0.081	95
241-B-112	0.540	15	241-T-104	0.010	298
241-B-201	0.017	556	241-T-105	0.254	32
241-B-202	0.018	556	241-T-106	0.091	190
241-B-203	0.018	556	241-T-107	0.040	189
241-B-204	0.018	556	241-T-108	0.138	†
241-BX-101	0.076	108	241-T-109	0.623	†
241-BX-102	0.074	109	241-T-110	0.000	439
241-BX-103	0.270	107	241-T-111	0.019	330
241-BX-104	0.106	†	241-T-112	0.018	330
241-BX-105	0.016	99	241-T-201	0.018	556
241-BX-106	0.071	97	241-T-202	0.018	556
241-BX-107	0.009	298	241-T-203	0.018	556
241-BX-108	0.030	176	241-T-204	0.018	556
241-BX-109	0.095	188	241-TX-101	0.737	21
241-BX-110	0.037	15	241-TX-102	0.417	35
241-BX-111	0.504	15	241-TX-103	0.418	†
241-BX-112	0.018	298	241-TX-104	0.730	20
241-BY-101	0.551	16	241-TX-105	0.417	35
241-BY-102	0.720	15	241-TX-106	0.453	29
241-BY-103	0.562	15	241-TX-107	0.755	†
241-BY-104	0.910	†	241-TX-108	0.415	35
241-BY-105	0.646	†	241-TX-109	0.021	298
241-BY-106	1.000	†	241-TX-110	0.393	35

Table 6-1. Aluminum Wash Factor Means and Uncertainties.

Tank	Wash Factor	RSD[1], (%)	Tank	Wash Factor	RSD, (%)
241-BY-107	0.928	†	241-TX-111	0.381	35
241-BY-108	0.647	†	241-TX-112	0.418	†
241-BY-109	0.333	19	241-TX-113	0.428	35
241-BY-110	0.860	†	241-TX-114	0.029	†
241-BY-111	0.621	15	241-TX-115	0.417	35
241-BY-112	0.621	15	241-TX-116	0.378	†
241-C-101	0.075	108	241-TX-117	0.425	†
241-C-102	0.004	*	241-TX-118	0.285	51
241-C-103	0.045	†	241-TY-101	0.259	†
241-C-104	0.012	†	241-TY-102	0.510	†
241-C-105	0.000	98	241-TY-103	0.156	53
241-C-106	0.000	*	241-TY-104	0.040	363
241-C-107	0.000	*	241-TY-105	0.066	188
241-C-108	0.030	159	241-TY-106	0.016	†
241-C-109	0.002	*	241-U-101	0.754	21
241-C-110	0.084	298	241-U-102	0.697	†
241-C-111	0.037	†	241-U-103	0.809	†
241-C-112	0.031	†	241-U-104	0.746	21
241-C-201	0.000	*	241-U-105	0.404	
241-C-202	0.000	*	241-U-106	0.679	18
241-C-203	0.000	*	241-U-107	0.704	†
241-C-204	0.000	*	241-U-108	0.877	†
241-S-101	0.133	†	241-U-109	0.503	†
241-S-102	0.932	†	241-U-110	0.020	128
241-S-103	0.833	†	241-U-111	0.837	†
241-S-104	0.040	†	241-U-112	0.441	28
241-S-105	0.751	14	241-U-201	0.103	196
241-S-106	0.751	18	241-U-202	0.103	196
241-S-107	0.065	†	241-U-203	0.103	196
241-S-108	0.751	17	241-U-204	0.103	196
241-S-109	0.928	14	-	-	-
Double-Shell Tanks					
241-AN-101	N/A	N/A	241-AP-108	N/A	N/A
241-AN-102	0.973	7.5	241-AW-101	0.930	7.5
241-AN-103	0.983	7.5	241-AW-102	0.076	109
241-AN-104	1.000	7.5	241-AW-103	0.673	†
241-AN-105	0.977	7.5	241-AW-104	0.811	†
241-AN-106	0.000	*	241-AW-105	0.046	†
241-AN-107	0.973	7.5	241-AW-106	0.973	7.5
241-AP-101	N/A	N/A	241-AY-101	0.190	143
241-AP-102	0.188	143	241-AY-102	0.069	210
241-AP-103	N/A	N/A	241-AZ-101	0.023	624
241-AP-104	N/A	N/A	241-AZ-102	0.025	624
241-AP-105	0.973	7.5	241-SY-101	0.090	161
241-AP-106	N/A	N/A	241-SY-102	0.229	63
241-AP-107	N/A	N/A	241-SY-103	0.090	161

Notes: [1] RSD, relative standard deviation, the standard deviation divided by the mean and multiplied by 100%.

* Leach factor was neglibible for this waste.

† The data was insufficient or non-existent for the waste types in these tanks. Average factors for saltcake waste and/or sludge waste were assigned and no reasonable estimate of uncertainty is possible.

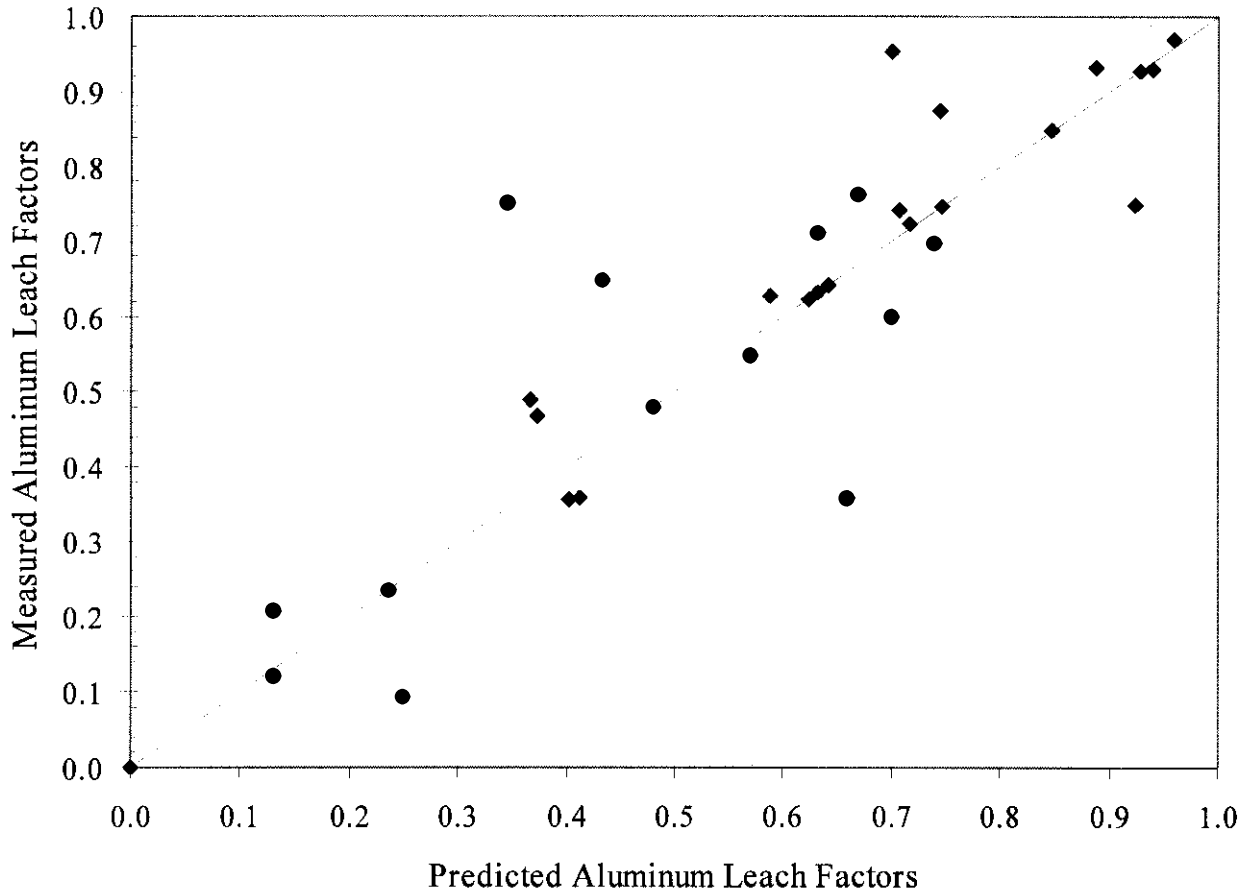
N/A= Not Applicable, this tank contains only aqueous waste.

6.2 ALUMINUM LEACH FACTORS AND UNCERTAINTIES

6.2.1 Leach Factor Model Comparison With Training Set Data

Figure 6-2 shows a plot of the measured versus predicted leach factors using the waste type model for 32 SSTs and 2 DSTs. This data represents the training set that was used to develop the model. The linear regression coefficient of determination (R^2) for this set is 0.79, which indicates a reasonable correlation between the measured and predicted wash factors for these tanks.

Figure 6-2. Aluminum Leach Factor Model Comparison With Training Set Data.



6.2.2 Leach Factor Prediction for All Tanks

Table 6-2 presents aluminum leach factors for all 149 SSTs and 28 DSTs. Shaded values are from sample analyses and nonshaded from waste type model predictions. Included in Table 6-2 are uncertainty estimates (RSDs) for the leach factors.

Table 6-2. Aluminum Leach Factor Means and Uncertainties.

Tank	Leach Factor	RSD[1], (%)	Tank	Leach Factor	RSD, (%)
Single-Shell Tanks					
241-A-101	0.461	19	241-S-110	0.490	50
241-A-102	0.374	†	241-S-111	0.360	68
241-A-103	0.375	†	241-S-112	0.403	†
241-A-104	0.517	†	241-SX-101	0.469	†
241-A-105	0.588	36	241-SX-102	0.395	†
241-A-106	0.397	84	241-SX-103	0.365	216
241-AX-101	0.374	†	241-SX-104	0.322	149
241-AX-102	0.033	†	241-SX-105	0.457	†
241-AX-103	0.522	28	241-SX-106	0.000	*
241-AX-104	0.588	36	241-SX-107	0.247	80
241-B-101	0.455	336	241-SX-108	0.236	91
241-B-102	0.000	*	241-SX-109	0.326	95
241-B-103	0.000	*	241-SX-110	0.285	73
241-B-104	0.360	52	241-SX-111	0.261	72
241-B-105	0.011	†	241-SX-112	0.254	75
241-B-106	0.742	12	241-SX-113	0.642	33
241-B-107	0.485	99	241-SX-114	0.312	86
241-B-108	0.735	49	241-SX-115	0.236	91
241-B-109	0.824	30	241-T-101	0.932	126
241-B-110	0.349	42	241-T-102	0.961	16
241-B-111	0.016	36	241-T-103	0.969	30
241-B-112	0.625	28	241-T-104	0.474	14
241-B-201	0.208	111	241-T-105	0.612	76
241-B-202	0.122	111	241-T-106	0.953	117
241-B-203	0.131	111	241-T-107	0.722	12
241-B-204	0.131	111	241-T-108	0.634	13
241-BX-101	0.960	16	241-T-109	0.374	†
241-BX-102	0.960	16	241-T-110	0.750	43
241-BX-103	0.970	16	241-T-111	0.094	40
241-BX-104	0.778	70	241-T-112	0.252	40
241-BX-105	0.848	13	241-T-201	0.131	111
241-BX-106	0.850	13	241-T-202	0.131	111
241-BX-107	0.600	14	241-T-203	0.131	111
241-BX-108	0.708	12	241-T-204	0.131	111
241-BX-109	0.698	25	241-TX-101	0.510	†
241-BX-110	0.933	24	241-TX-102	0.374	†
241-BX-111	0.798	15	241-TX-103	0.374	†
241-BX-112	0.593	14	241-TX-104	0.495	†
241-BY-101	0.709	33	241-TX-105	0.374	†
241-BY-102	1.000	35	241-TX-106	0.380	†
241-BY-103	0.980	19	241-TX-107	0.374	†
241-BY-104	0.928	23	241-TX-108	0.376	0.4
241-BY-105	0.901	29	241-TX-109	0.700	14
241-BY-106	0.000		241-TX-110	0.405	2.4

Table 6-2. Aluminum Leach Factor Means and Uncertainties.

Tank	Leach Factor	RSD[1], (%)	Tank	Leach Factor	RSD, (%)
241-BY-107	0.995	33	241-TX-111	0.420	3.4
241-BY-108	0.996	33	241-TX-112	0.374	†
241-BY-109	0.965	15	241-TX-113	0.374	†
241-BY-110	0.989	30	241-TX-114	0.377	0.3
241-BY-111	1.000	35	241-TX-115	0.375	0.1
241-BY-112	1.000	35	241-TX-116	0.460	13
241-C-101	0.959	16	241-TX-117	0.379	1.1
241-C-102	0.749	23	241-TX-118	0.468	†
241-C-103	0.799	12	241-TY-101	0.373	51
241-C-104	0.826	101	241-TY-102	0.374	†
241-C-105	0.939	14	241-TY-103	0.535	23
241-C-106	0.000	*	241-TY-104	0.480	45
241-C-107	0.623	34	241-TY-105	0.739	25
241-C-108	0.762	13	241-TY-106	0.840	33
241-C-109	0.632	34	241-U-101	0.517	†
241-C-110	0.700	14	241-U-102	0.446	†
241-C-111	0.603	32	241-U-103	0.409	†
241-C-112	0.547	37	241-U-104	0.531	2.7
241-C-201	0.178	1122	241-U-105	0.935	126
241-C-202	0.178	1122	241-U-106	0.374	†
241-C-203	0.178	1122	241-U-107	0.966	129
241-C-204	0.178	1122	241-U-108	0.856	119
241-S-101	0.357	42	241-U-109	0.945	127
241-S-102	0.436	†	241-U-110	0.653	50
241-S-103	0.438	†	241-U-111	0.495	3.3
241-S-104	0.469	58	241-U-112	0.874	109
241-S-105	0.400	†	241-U-201	1.000	132
241-S-106	0.374	†	241-U-202	1.000	132
241-S-107	0.710	30	241-U-203	1.000	132
241-S-108	0.384	†	241-U-204	1.000	132
241-S-109	0.472	†	-	-	-
Double-Shell Tanks					
241-AN-101	N/A	N/A	241-AP-108	N/A	N/A
241-AN-102	0.000	*	241-AW-101	0.961	16
241-AN-103	0.000	*	241-AW-102	0.892	937
241-AN-104	0.000	*	241-AW-103	0.458	5.3
241-AN-105	0.000	*	241-AW-104	0.791	725
241-AN-106	0.000	*	241-AW-105	0.000	*
241-AN-107	0.000	*	241-AW-106	0.517	†
241-AP-101	N/A	N/A	241-AY-101	0.000	*
241-AP-102	0.517	†	241-AY-102	0.588	36
241-AP-103	N/A	N/A	241-AZ-101	0.961	16
241-AP-104	N/A	N/A	241-AZ-102	0.628	36
241-AP-105	0.000	*	241-SY-101	0.746	29
241-AP-106	N/A	N/A	241-SY-102	0.517	†
241-AP-107	N/A	N/A	241-SY-103	0.746	29

Notes: [1] RSD, relative standard deviation, the standard deviation divided by the mean and multiplied by 100%.
* Leach factor was neglibible for this waste.
† The data was insufficient or non-existent for the waste types in these tanks. Average factors for saltcake waste and/or sludge waste were assigned and no reasonable estimate of uncertainty is possible.
N/A= Not Applicable, this tank contains only aqueous waste.

7.0 CONCLUSIONS

This study shows that the SORWT model over-estimates the total amount of aluminum in some wastes, especially the REDOX waste tanks, and also over-estimates the amount of aluminum leached out of many of the S and SX farm tanks. The SORWT model caustic leach factor appears to be too high, especially for the REDOX subgroup represented by tanks 241-S-101 and 241-S-111 (SORWT groups I, V, and IX and tank 241-TX-108). The SOWRT model predictions are not reliable because the leach factor estimates are based on the maximum rather than an 8-hour caustic leaching process.

The cluster analysis model uses cluster analysis statistical techniques to group the tanks and mass weighted averaging of the data to develop tank-specific wash and leach factors for the tanks in each group. Comparisons between the predicted wash-leach factors and measured values show that the cluster analysis produces unreliable predictions for many tanks.

The waste type models developed in this report provide a good fit with the experimental wash and leach factor data from most tanks. While the waste type models are not perfect, the accuracy of these models can be judged by comparing model predictions to the experimental data from a large number of tanks. These comparisons are generally quite favorable for most tanks and support the general use of these estimates in the HTWOS model.

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8.0 RECOMMENDATIONS

Waste types BYSltCk, AR, A1SltCk, T1SltCk, MW, PL2, R1-boiling, and S1SltCk-nonboiling had no aluminum caustic leach measurements. Therefore, average leach factors for saltcake and sludge wastes were assigned to tanks containing these waste types (see Appendix C). The CWR waste type had a best fit leach factor of 2.0, a physical impossibility. Therefore, a leach value of 1.0 was assigned. The CWR result suggests that the samples were biased (i.e., the samples actually contained little or no CWR waste so that its leach factor could not be accurately measured). Any future analytical efforts should focus on these 9 waste types.

Model predictions for the unanalyzed tanks could be tested by measuring additional tanks not used to develop the model. The data set was too small to withhold data from model development for testing purposes. Model predictions should be tested if any new aluminum wash-leach data become available.

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APPENDIX A

ALUMINUM WASH AND LEACH LABORATORY STUDIES

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APPENDIX A

ALUMINUM WASH AND LEACH LABORATORY STUDIES

NOTE: Some caustic leach results are based on water-washed solids (simple caustic leach factors), while others are based on the original solids (combined water wash and caustic leach factors).

Table A-1. Dilute Caustic Water Wash Test Results with Hanford Site Sludges. (3 sheets)

Tank	Waste type	Percentage removed during 0.01M NaOH water wash			Reference
		Al	Cr	P	
B-101	--	25	21	67	PNNL-12026, 1998, *Water Washing and Caustic Leaching of Hanford Sludges: Results of FY 1998 Studies*, Pacific Northwest National Laboratory, Richland, Washington.
B-106	1C, TBP, BiPO4	28	12	60	LAUR 97-2889, 1997, *Sludge Water Washing and Alkaline Tests on Actual Hanford Tank Sludge: FY 1997 Results*, Los Alamos National Laboratory, Los Alamos, New Mexico. Three, sequential 1-hour water washes at 100 °C.
BX-103	TBP, CW, OWW	1	27	49	LAUR 97-2889 Three, sequential 1-hour water washes at 100 °C.
BX-110	--	4	23	97	PNNL-12026
BX-112	--	5	19	24	PNNL-12026
BY-104	TBP	65	69	93	PNNL-11278, 1996, *Water Washing and Caustic Leaching of Hanford Tank Sludges: Results of FY 1996 Studies*, Pacific Northwest National Laboratory, Richland, Washington.
BY-108	TBP, evaporator bottoms	63	49	73	PNNL-11636, 1997, *Water Washing and Caustic Leaching of Hanford Tank Sludge: Results of FY 1997 Studies*, Pacific Northwest National Laboratory, Richland, Washington.
BY-110	Evaporator bottoms, TBP	94	47	19	PNNL-11278
C-102	--	0.4	Cr below detection in sludge	25	PNNL-12026

Table A-1. Dilute Caustic Water Wash Test Results with Hanford Site Sludges. (3 sheets)

Tank	Waste type	Percentage removed during 0.01M NaOH water wash			Reference
		Al	Cr	P	
C-103	Sr caustic leached sludge SORWT Group XX	Not measured	Not measured	Not measured	ORNL/TM-13655, 1998, *Water Washes and Caustic Leaches of Sludge from Hanford Tank S-101 and Water Washes of Sludge from Hanford Tank C-103*, Oak Ridge National Laboratory, Oak Ridge, Tennessee.
C-104	CW, OWW, Sr-water wash, SRS	9	13	27	LAUR 97-2889 Three, sequential 1-hour water washes at 100 °C.
C-105	TBP, Sr-water wash, CW, P	0	81	100	LAUR 97-2889 Three, sequential 1-hour water washes at 100 °C.
C-106	--	14	8	36	PNWD-3013, 2000, *C-106 High-Level Waste Solids: Water Washing/Caustic Leaching and Solubility Versus Temperature Studies*, Pacific Northwest National Laboratory, Richland, Washington. Three 0.01M NaOH water washes at 85 °C, 18, 23, and 27 hours.
C-107	BiPO4, 1C, CW	1	34	69	PNNL-11278
S-101	REDOX, evaporator bottoms	11	46	55	PNNL-12026
S-101	REDOX, evaporator bottoms	12	44	87	PNNL-11636
S-101	REDOX, evaporator bottoms	11	46.3	79.7	ORNL/TM-13655
S-104	REDOX	2	94	>44	PNNL-11636
S-107	R-RCW, evaporator bottoms	8	24	100	PNNL-11278
S-111	REDOX, evaporator bottoms	10	18	100	PNNL-11636
SX-108	REDOX	6	71	9	PNNL-11278
SX-113	REDOX, diatomaceous earth	0	2	15	LAUR 97-2889 Three, sequential 1-hour water washes at 100 °C.

Table A-2. Caustic Leach Test Results with Hanford Site Sludges. (4 sheets)

Tank	Waste type	Percentage removed during ~3M NaOH caustic leach			Reference
		Al	Cr	P	
AZ-102	NCAW	66.7	58.3	52.3	PNWD-3045, 2000, *Characterization, Water Washing, Caustic Leaching and Filtration of AZ-102 Sludge*, Pacific Northwest National Laboratory, Richland, Washington. Caustic leaching and water washing steps conducted in Cells Unit Filter System. Three 0.01M NaOH water washes at ambient temperature, followed by one 3M NaOH caustic leach at 85 °C for 8-hours, and two 0.01M NaOH water washes at 85 °C for 8 hours each.
B-101	--	50	48	84	PNNL-12026, 1998, *Water Washing and Caustic Leaching of Hanford Sludges: Results of FY 1998 Studies*, Pacific Northwest National Laboratory, Richland, Washington. ~3M NaOH caustic leach at 100 °C
B-106	1C, TBP, BiPO4	86.1	77.6	93.7	LAUR 97-2889, 1997, *Sludge Water Washing and Alkaline Tests on Actual Hanford Tank Sludge: FY 1997 Results*, Los Alamos National Laboratory, Los Alamos, New Mexico. Two, sequential 5-hour 3M NaOH caustic leaches at 100 °C, followed by three, sequential 0.5-hour water washes at ambient.
BX-103	TBP, CW, OWW	99.6	56.5	95.5	LAUR 97-2889 Two, sequential 5-hour 3M NaOH caustic leaches at 100 °C, followed by three, sequential 0.5-hour water washes at ambient.
BX-110	--	99	93	98	PNNL-12026 ~3M NaOH caustic leach at 95 °C
BX-112	--	63	86	99	PNNL-12026 ~3M NaOH caustic leach at 80 °C
BY-104	TBP	98	71	95	PNNL-11278, 1996, *Water Washing and Caustic Leaching of Hanford Tank Sludge: Results of FY 1996 Studies*, Pacific Northwest National Laboratory, Richland, Washington.
BY-108	TBP, evaporator bottoms	71	43	70	PNNL-11636, 1997, *Water Washing and Caustic Leaching of Hanford Tank Sludge: Results of FY 1997 Studies*, Pacific Northwest National Laboratory, Richland, Washington.

Table A-2. Caustic Leach Test Results with Hanford Site Sludges. (4 sheets)

Tank	Waste type	Percentage removed during ~3M NaOH caustic leach			Reference
		Al	Cr	P	
BY-110	Evaporator bottoms, TBP	96	48	23	PNNL-11278
C-102	--	95	Cr below detection limit in sludge	48	PNNL-12026 ~3M NaOH caustic leach at 100 °C
C-104	CW, OWW, Sr-water wash, SRS	97.1	52.1	89.4	LAUR 97-2889 Two, sequential 5-hour 3M NaOH caustic leaches at 100 °C, followed by three, sequential 0.5-hour water washes at ambient.
C-104	CW, OWW, Sr-water wash, SRS	83.1 to 90.2	60 to 73.6	N/A	ORNL/TM-13500, 1998, *Caustic Leaching of Sludges from Selected Hanford Tanks*, Oak Ridge National Laboratory, Oak Ridge, Tennessee. Test #13 (4M NaOH, 93 °C, 65-hour caustic leach). Lower values are based on caustic leachate and rinse analysis versus residue. Test results compare well with LAUR 97-2889 and PNWD-3024, 2000, *Characterization, Water Washing, Caustic Leaching and Filtration of C-104 Sludge*, Pacific Northwest National Laboratory, Richland, Washington, except Cr removal was only ~50%.
C-104	CW, OWW, Sr-water wash, SRS	93.2	50.5	71	PNWD-3024 Caustic leaching and water washing steps conducted in Cells Unit Filter System. Three 0.01M NaOH water washes at ambient temperature, followed by one 3M NaOH caustic leach at 85 °C for 8-hours, and two 0.01M NaOH water washes at 85 °C for 8 hours each.
C-105	TBP, Sr-water wash, CW, P	93 to 97.3	71.2 to 88.4	93.7 to 112	ORNL/TM-13500 Test #7 (6.3M NaOH, 70 °C, 22-hour caustic leach). Lower values are based on caustic leachate and rinse analysis versus residue. Test results compare well with LAUR 97-2889.
C-105	TBP, Sr-water wash, CW, P	99	13.7	0	LAUR 97-2889 Two, sequential 5-hour 3M NaOH caustic leaches at 100 °C, followed by three, sequential 0.5-hour water washes

Table A-2. Caustic Leach Test Results with Hanford Site Sludges. (4 sheets)

Tank	Waste type	Percentage removed during ~3M NaOH caustic leach			Reference
		Al	Cr	P	
					at ambient.
C-106	--	22	27	41	PNWD-3013, 2000, *C-106 High-Level Waste Solids: Water Washing/Caustic Leaching and Solubility Versus Temperature Studies*, Pacific Northwest National Laboratory, Richland, Washington. 3M NaOH caustic leach at 85 °C, 20 hours, followed by two 0.01M NaOH water washes at 85 °C, 23 to 28 hours.
C-107	BiPO4, 1C, CW	78	48	94	PNNL-11278
C-107	BiPO4, 1C, CW	79.7 to 82	65.8 to 70.3	93.8 to 106	ORNL/TM-13500 Test #8 (6.3M NaOH, 70 °C, 22-hour caustic leach). Lower values are based on caustic leachate and rinse analysis versus residue.
S-101	REDOX evaporator bottoms	89	76	N/A	PNNL-12026 ~3M NaOH caustic leach at 95 °C
S-101	REDOX evaporator bottoms	97.3 to 97.8	85.7 to 126	N/A	ORNL/TM-13500 Test #14 (4M NaOH, 93°C, 65-hour caustic leach). Lower values are based on caustic leachate and rinse analysis versus residue. Test results compare well with PNNL-11636
S-101	REDOX evaporator bottoms SORWT Group I	91.5	86.5	>99.9	ORNL/TM-13655, 1998, *Water Washes and Caustic Leaches of Sludges from Hanford Tank S-101 and Water Washes of Sludge from Hanford Tank C-103*, Oak Ridge National Laboratory, Oak Ridge, Tennessee. Percentage removals are for combined water wash and caustic leach at 95 °C.
S-101	REDOX, evaporator bottoms	96	89	97	PNNL-11636
S-104	REDOX	99	99	>58	PNNL-11636

Table A-2. Caustic Leach Test Results with Hanford Site Sludges. (4 sheets)

Tank	Waste type	Percentage removed during ~3M NaOH caustic leach			Reference
		Al	Cr	P	
S-104	REDOX	11 to 20	97.4 to 99.8	1 to 44	ORNL/TM-13500 Test #3 (4M NaOH, 70 °C, 21-hour caustic leach). Lower values are based on caustic leachate and rinse analysis versus residue. Test results compare well with PNL-10712, 1995, *Water Washing and Caustic Leaching of Hanford Tank Sludges: Results of FY 1995 Studies*, Pacific Northwest National Laboratory, Richland, Washington, and PNNL-11636 for Cr.
S-107	R-RCW, evaporator bottoms	73	53	98	PNNL-11278
S-111	REDOX, evaporator bottoms	100	98	100	PNNL-11636
SX-108	REDOX	29	78	37	PNNL-11278
SX-113	REDOX, diatomaceous earth	51 to 62.1	17.3 to 52.9	11.8 to 12.6	ORNL/TM-13500 Test #6 (6.3M NaOH, 70°C, 21-hour caustic leach). Lower values are based on caustic leachate and rinse analysis versus residue.
SX-113	REDOX, diatomaceous earth	89.2	40.1	85.4	LAUR 97-2889 Two, sequential 5-hour 3M NaOH caustic leaches at 100 °C, followed by three, sequential 0.5-hour water washes at ambient.

N/A = not applicable.

APPENDIX B
DATA FOR FIGURES 3-1 AND 3-2

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APPENDIX B

DATA FOR FIGURES 3-1 AND 3-2

Figure 3-1 plots measured aluminum wash factors against those predicted by the cluster analysis and values plotted are shown in Table B-1. The measured wash factors (column 2) are those shown in Tables 4-1 and 4-2 of the main text. The predicted wash factors (column 3) are from Tables I-1 through I-18 in Appendix I of HNF-3157, Rev. 0A.

Table B-1. Data for Figure 3-1.

Tank	Measured Al Wash Factor	Cluster Analysis Predicted Al Wash Factor
241-A-101	0.879	0.879
241-AN-103	0.983	0.828
241-AN-104	0.990	0.695
241-AN-105	0.977	0.378
241-AW-101	0.930	0.828
241-AX-101	0.948	0.177
241-AY-102	0.069	0.001
241-AZ-102	0.025	0.131
241-B-101	0.250	0.828
241-B-104	0.060	0.060
241-B-106	0.063	0.063
241-B-108	0.011	0.039
241-B-110	0.020	0.000
241-B-111	0.008	0.000
241-B-201	0.017	0.013
241-B-202	0.018	0.020
241-BX-103	0.270	0.010
241-BX-105	0.000	0.042
241-BX-107	0.009	0.010
241-BX-109	0.095	0.145
241-BX-110	0.010	0.521
241-BX-112	0.018	0.027
241-BY-102	0.720	0.337
241-BY-104	0.910	0.797
241-BY-106	1.000	1.000
241-BY-107	0.928	0.913
241-BY-110	0.860	0.839
241-C-103	0.000	0.001
241-C-104	0.012	0.017
241-C-105	0.000	0.002
241-C-106	0.240	0.001
241-C-107	0.000	0.010
241-C-108	0.030	0.027
241-C-109	0.002	0.006
241-C-110	0.084	0.082
241-C-112	0.031	0.052
241-S-101	0.133	0.130
241-S-102	0.932	0.788
241-S-104	0.040	0.057
241-S-107	0.065	0.097
241-S-109	0.928	0.792

Table B-1. Data for Figure 3-1.

Tank	Measured Al Wash Factor	Cluster Analysis Predicted Al Wash Factor
241-SX-101	0.974	0.833
241-SX-103	0.208	0.997
241-SX-108	0.163	0.127
241-SX-113	0.000	0.010
241-SY-103	0.090	0.090
241-T-102	0.003	0.003
241-T-104	0.010	0.010
241-T-107	0.040	0.058
241-T-111	0.019	0.020
241-TX-113	0.428	0.521
241-TX-118	0.285	0.521
241-TY-104	0.040	0.075
241-U-105	0.404	0.412
241-U-106	0.679	0.660
241-U-108	0.877	0.897
241-U-109	0.503	0.632

Notes:

Figure 3-2 plots measured aluminum leach factors against those predicted by the cluster analysis, and data plotted are shown in Table B-2. The measured leach factors (column 2) are those shown in Tables 4-1 and 4-2 of the main text. The predicted leach factors (column 3) are from Tables I-1 through I-18 in Appendix I of HNF-3157, Rev. 0A.

Table B-2. Data for Figure 3-2.

Tank	Measured Al Leach Factor	Cluster Analysis Predicted Al Leach Factor
241-AN-104	0.000	0.990
241-AZ-102	0.628	0.687
241-B-101	0.455	0.000
241-B-104	0.360	0.602
241-B-106	0.742	0.852
241-B-111	0.016	0.020
241-B-201	0.208	0.271
241-B-202	0.122	0.143
241-BX-103	0.970	0.997
241-BX-105	0.842	0.381
241-BX-107	0.600	0.680
241-BX-109	0.698	0.972
241-BX-110	0.928	0.570
241-BX-112	0.642	0.390
241-BY-104	0.928	0.941
241-BY-110	0.198	0.752
241-C-102	0.749	0.883
241-C-103	0.352	0.480
241-C-104	0.874	0.969
241-C-105	0.930	0.988
241-C-107	0.623	0.616
241-C-108	0.762	0.931
241-C-109	0.632	0.808
241-C-112	0.616	0.840
241-S-101	0.357	0.977

Table B-2. Data for Figure 3-2.

Tank	Measured Al Leach Factor	Cluster Analysis Predicted Al Leach Factor
241-S-104	0.469	0.987
241-S-107	0.710	0.612
241-SX-108	0.236	0.333
241-SX-113	0.642	0.888
241-T-104	0.471	0.625
241-T-107	0.722	0.766
241-T-111	0.094	0.112
241-TY-104	0.480	0.601
241-U-110	0.643	0.838

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APPENDIX C

STATISTICAL ANALYSIS

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APPENDIX C

STATISTICAL ANALYSIS

C1.0 INTRODUCTION

Multiple regression analysis was used to estimate the aluminum wash and leach factors. In multiple regression, several predictors are used to model a single response variable. In this case, the predictors, or X matrix of variables, represent the mass fractions of waste types within each tank, while the response variable is the measured tank wash factors. For each of the n cases observed, values for the response and predictors are collected. If the response is called Y, and the predictors $X_1, X_2, \ldots, X_p$, then the data will look like the following matrix array:

Case Number	Y	X_1	X_2	X_3	.	.	.	X_p
1	y_1	x_{11}	x_{12}	x_{13}	.	.	.	x_{1p}
2	y_2	x_{21}	x_{22}	x_{23}	.	.	.	x_{2p}
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
n	y_n	x_{n1}	x_{n2}	x_{n3}	.	.	.	x_{np}

The equation that expresses the response as a linear function of the p predictors is estimated using the observed data. The model is specified by the linear equation

$$= \beta \cdot \quad + \beta \cdot \quad + \ldots + \beta \cdot \quad + \varepsilon \qquad \text{(C-1)}$$

where the β's are unknown parameters, the ε's are the statistical errors, Y is the response, and $X_1, X_2, \ldots, X_p$ are the predictors. Note that Equation C-1 has no intercept. This is because each estimate of β is of interest (unknown waste type wash factors) and having a non-zero intercept would not make sense. Therefore, the intercept is equal to zero and the fitted line goes through the origin. The use of this no-intercept model is based on the assumption that Equation C-1 is true if each β represents a waste type wash/leach factor, each X represents a mass proportion of that waste type, and each Y represents the tank wash/leach factor. This equation is assumed to be the correct calculation for determining tank wash/leach factors. This assumption is the basis for the analysis described in this appendix.

The matrix notation for this model is

$$Y = \begin{bmatrix} y_1 \\ y_2 \\ . \\ . \\ . \\ y_p \end{bmatrix} \quad X = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1p} \\ x_{21} & x_{22} & \dots & x_{2p} \\ \dots & \dots & \dots & \dots \\ x_{n1} & x_{n2} & \dots & x_{np} \end{bmatrix} \quad \beta = \begin{bmatrix} \beta_1 \\ \beta_2 \\ . \\ . \\ . \\ \beta_p \end{bmatrix} \quad e = \begin{bmatrix} e_1 \\ e_2 \\ . \\ . \\ . \\ e_n \end{bmatrix}$$

So

$$\mathbf{Y}=\mathbf{X}\boldsymbol{\beta} + \mathbf{e} \tag{C-2}$$

The assumptions concerning the e_i's are

$$E(\mathbf{e})=\mathbf{0},\ \mathrm{var}(e)=\sigma^2\mathbf{I}_n \tag{C-3}$$

Where var(**e**) is the variance-covariance matrix of **e**, $\mathbf{I}_n$ is the nXn identity matrix, and **0** is an nX1 vector of zeroes. Each e_i is normally distributed.

The waste type wash/leach factor estimates, or β's, are calculated using least squares. The β's are chosen such that the residual sum of squares is minimized. The least squares estimate $\hat{\beta}$ of β is calculated by the following formula:

$$\hat{\beta} = (X'X)^{-1} X'Y \tag{C-4}$$

provided that $(X'X)^{-1}$ exists.

Since the interest is in the waste type wash/leach factor estimates, $\hat{\beta}$, and assuming $E(\mathbf{e})=\mathbf{0}$ and $\mathrm{var}(e)=\sigma^2\mathbf{I}_n$, then $\hat{\beta}$ is unbiased, and

$$E(\hat{\beta}) = \beta \tag{C-5}$$

$$\text{and} \quad \mathrm{var}(\hat{\beta}) = \sigma^2 (X'X)^{-1}. \tag{C-6}$$

An estimate of σ^2 is obtained by

$$\hat{\sigma}^2 = (Y'Y - \hat{\beta}X'Y)/(n-p). \tag{C-7}$$

where Y is the response, $\hat{\beta}$ is the estimated waste type factor vector, n is the number of data points, and p is the number of predictors.
Also, there is interest in predicting tank wash/leach factors. Using the model Equation C-2,

$$\hat{Y} = X'\hat{\beta} \tag{C-8}$$

and the standard error is given by:

$$se(\hat{Y}/X) = \sigma^2 \sqrt{x'(X'X)^{-1}x} \tag{C-9}$$

In this methodology, the X's, or proportions, are treated as data values. In reality, they are estimated mass weights based on domain knowledge of the waste in each tank and have uncertainties associated with them that are not accommodated in this methodology.

C2.0 APPROACH AND RESULTS

For the estimates and predictions to be as accurate as possible, the mass fraction for the wash factors were determined based on the amount of aluminum in the samples. For tanks where no samples are available, domain information was gathered from the best basis inventory and the cited references in the main text. Furthermore, certain tank samples were deemed unsuitable for use in determining the model. This is because some samples may have come from only one segment in the tank, and determining which waste types were represented in the sample was not possible. Rather than speculate with little or no information, these data points were left out of the model and estimated using the prediction model. For wash data, tanks 241-C-106 and 241-T-105 the following tanks had wash data deemed inappropriate for the model: C-106 and T-105. For leach data, the tanks were BY-110, C-103, C-104, C-106, S-101 and S-111. The decision to leave these tanks out of the model were hard decisions, as there is approximately half the amount of leach data as there is wash data. However, for the integrity of the model, it was necessary to omit these tanks and predict their factors accordingly.

The proportions and tank wash/leach factors that were used in determining the models are shown in Tables C-1 and C-2.

Table C-1. Measured Aluminum Wash Factor and Tank Specific Aluminum Mass Fractions.

Tank	TWF	1C	1CFeCN	224	2C	A1SltCk	A2SltSlr	AR	B	BL	BSltCk	BYSltCk	CWP	CWR
A-101	0.879	0	0	0	0	0.956	0	0	0	0	0	0	0	0
A-102	.	0	0	0	0	1	0	0	0	0	0	0	0	0
A-103	.	0	0	0	0	0.999	0	0.001	0	0	0	0	0	0
A-104	.	0	0	0	0	0	0	0.962	0	0	0	0	0	0
A-105	.	0	0	0	0	0	0	0	0	0	0	0	0	0
A-106	.	0	0	0	0	0.368	0	0.264	0	0	0	0	0	0
AX-101	0.948	0	0	0	0	1	0	0	0	0	0	0	0	0
AX-102	.	0	0	0	0	0.582	0	0	0	0.418	0	0	0	0
AX-103	.	0	0	0	0	0.87	0	0	0	0	0	0	0	0
AX-104	.	0	0	0	0	0	0	0	0	0	0	0	0	0
B-101	0.250	0	0	0	0	0	0	0	0.076	0.297	0.627	0	0	0
B-102	.	0	0	0	0	0	0	0	0	0	1	0	0	0
B-103	.	0	0	0	0	0	0	0	0	0	1	0	0	0
B-104	0.060	0.342	0	0	0.505	0	0	0	0	0	0.153	0	0	0
B-105	.	0.015	0	0	0.002	0	0	0	0	0	0.982	0	0	0
B-106	0.063	0.839	0	0	0	0	0	0	0	0	0	0	0	0
B-107	.	0.608	0	0	0	0	0	0	0	0	0.323	0	0.069	0
B-108	0.011	0	0	0	0	0	0	0	0	0	0.225	0	0.775	0
B-109	.	0	0	0	0	0	0	0	0	0	0.136	0	0.864	0
B-110	0.020	0	0	0	0.988	0	0	0	0	0	0	0	0	0
B-111	0.008	0	0	0	0.889	0	0	0	0	0	0	0	0	0
B-112	.	0	0	0	0.135	0	0	0	0	0	0	0.865	0	0
B-201	0.017	0	0	1	0	0	0	0	0	0	0	0	0	0
B-202	0.018	0	0	1	0	0	0	0	0	0	0	0	0	0
B-203	.	0	0	1	0	0	0	0	0	0	0	0	0	0
B-204	.	0	0	1	0	0	0	0	0	0	0	0	0	0
BX-101	.	0	0	0	0	0	0	0	0	0	0	0	0.995	0
BX-102	.	0	0	0	0	0	0	0	0	0	0	0	0.985	0
BX-103	0.270	0	0	0	0	0	0	0	0	0	0	0	0.989	0
BX-104	.	0	0	0	0	0	0	0	0	0	0	0	0.139	0.44
BX-105	0.016	0	0	0	0	0	0	0	0	0	0	0	0.483	0
BX-106	.	0	0	0	0	0	0	0	0	0	0	0	0.5	0
BX-107	0.009	1	0	0	0	0	0	0	0	0	0	0	0	0
BX-108	.	0.8	0	0	0	0	0	0	0	0	0	0	0	0
BX-109	0.095	0	0	0	0	0	0	0	0	0	0	0	0	0
BX-110	0.037	0.19	0	0	0	0	0	0	0	0	0	0.81	0	0
BX-111	.	0.195	0	0	0	0	0	0	0	0	0	0.805	0	0
BX-112	0.044	1	0	0	0	0	0	0	0	0	0	0	0	0
BY-101	.	0	0	0	0	0	0	0	0	0	0	0.883	0	0
BY-102	0.720	0	0	0	0	0	0	0	0	0	0	1	0	0
BY-103	.	0	0	0	0	0	0	0	0	0	0	0.891	0.109	0
BY-104	0.910	0	0	0	0	0	0	0	0	0	0	0.683	0	0
BY-105	.	0	0	0	0	0	0	0	0	0	0	0.875	0	0
BY-106	1.000	0	0	0	0	0	0	0	0	0	0	0.889	0	0
BY-107	0.928	0	0	0	0	0	0	0	0	0	0	0.911	0	0
BY-108	.	0	0	0	0	0	0	0	0	0	0	0.933	0	0
BY-109	.	0	0	0	0	0	0	0	0	0	0	0.471	0.529	0
BY-110	0.860	0	0	0	0	0	0	0	0	0	0	0.795	0	0
BY-111	.	0	0	0	0	0	0	0	0	0	0	1	0	0
BY-112	.	0	0	0	0	0	0	0	0	0	0	1	0	0
C-101	.	0	0	0	0	0	0	0	0	0	0	0	0.99	0
C-102	.	0	0	0	0	0	0	0	0	0	0	0	0.947	0
C-103	0.000	0	0	0	0	0	0	0.403	0	0	0	0	0.597	0
C-104	0.012	0	0	0	0	0	0	0	0	0	0	0	0.57	0
C-105	0.000	0	0	0	0	0	0	0	0	0	0	0	0.9	0
C-106	0.240	0	0	0	0	0	0	1	0	0	0	0	0	0
C-107	0.000	0.325	0	0	0	0	0	0	0	0	0	0	0.284	0
C-108	0.030	0.44	0	0	0	0	0	0	0	0	0	0	0	0
C-109	0.002	0.036	0	0	0	0	0	0	0	0	0	0	0.411	0
C-110	0.084	1	0	0	0	0	0	0	0	0	0	0	0	0
C-111	.	0.037	0	0	0	0	0	0	0	0	0	0	0.344	0
C-112	0.031	0.145	0	0	0	0	0	0	0	0	0	0	0.163	0

Table C-1. Measured Aluminum Wash Factor and Tank Specific Aluminum Mass Fractions.

Tank	TWF	1C	1CFeCN	224	2C	A1SltCk	A2SltSlr	AR	B	BL	BSltCk	BYSltCk	CWP	CWR
C-201	.	0	0	0	0	0	0	0	0	0	0	0	0	0
C-202	.	0	0	0	0	0	0	0	0	0	0	0	0	0
C-203	.	0	0	0	0	0	0	0	0	0	0	0	0	0
C-204	.	0	0	0	0	0	0	0	0	0	0	0	0	0
S-101	0.133	0	0	0	0	0	0	0	0	0	0	0	0	0.131
S-102	0.932	0	0	0	0	0	0	0	0	0	0	0	0	0
S-103	.	0	0	0	0	0	0	0	0	0	0	0	0	0
S-104	0.040	0	0	0	0	0	0	0	0	0	0	0	0	0.096
S-105	.	0	0	0	0	0	0	0	0	0	0	0	0	0
S-106	.	0	0	0	0	0	0	0	0	0	0	0	0	0
S-107	0.065	0	0	0	0	0	0	0	0	0	0	0	0	0.544
S-108	.	0	0	0	0	0	0	0	0	0	0	0	0	0
S-109	0.928	0	0	0	0	0	0	0	0	0	0	0	0	0
S-110	0.070	0	0	0	0	0	0	0	0	0	0	0	0	0.187
S-111	0.499	0	0	0	0	0	0	0	0	0	0	0	0	0.127
S-112	.	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-101	0.974	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-102	.	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-103	0.208	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-104	.	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-105	.	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-106	.	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-107	.	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-108	0.163	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-109	.	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-110	.	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-111	.	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-112	.	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-113	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-114	.	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-115	.	0	0	0	0	0	0	0	0	0	0	0	0	0
T-101	.	0	0	0	0	0	0	0	0	0	0	0	0	0.845
T-102	0.003	0	0	0	0	0	0	0	0	0	0	0	1	0
T-103	.	0	0	0	0	0	0	0	0	0	0	0	0.791	0.209
T-104	0.010	1	0	0	0	0	0	0	0	0	0	0	0	0
T-105	0.003	0.044	0	0	0.377	0	0	0	0	0	0	0	0	0.293
T-106	.	0.145	0	0	0	0	0	0	0	0	0	0	0	0.855
T-107	0.040	0.854	0	0	0	0	0	0	0	0	0	0	0.049	0
T-108	.	0.805	0	0	0	0	0	0	0	0	0	0	0	0
T-109	.	0	0	0	0	0	0	0	0	0	0	0	0	0
T-110	0.000	0	0	0.003	0.997	0	0	0	0	0	0	0	0	0
T-111	0.019	0	0	0.448	0.552	0	0	0	0	0	0	0	0	0
T-112	.	0	0	0.438	0.562	0	0	0	0	0	0	0	0	0
T-201	.	0	0	1	0	0	0	0	0	0	0	0	0	0
T-202	.	0	0	1	0	0	0	0	0	0	0	0	0	0
T-203	.	0	0	1	0	0	0	0	0	0	0	0	0	0
T-204	.	0	0	1	0	0	0	0	0	0	0	0	0	0
TX-101	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-102	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-103	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-104	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-105	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-106	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-107	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-108	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-109	.	1	0	0	0	0	0	0	0	0	0	0	0	0
TX-110	.	0.061	0	0	0	0	0	0	0	0	0	0	0	0
TX-111	.	0.091	0	0	0	0	0	0	0	0	0	0	0	0
TX-112	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-113	0.428	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-114	.	0.006	0	0	0	0	0	0	0	0	0	0	0	0
TX-115	.	0	0	0	0	0	0	0	0	0	0	0	0	0

Table C-1. Measured Aluminum Wash Factor and Tank Specific Aluminum Mass Fractions.

Tank	TWF	1C	1CFeCN	224	2C	A1SltCk	A2SltSlr	AR	B	BL	BSltCk	BYSltCk	CWP	CWR
TX-116	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-117	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-118	0.285	0	0	0	0	0	0	0	0	0	0	0	0	0
TY-101	.	0	0.613	0	0	0	0	0	0	0	0	0	0	0
TY-102	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TY-103	.	0	0.31	0	0	0	0	0	0	0	0	0	0	0
TY-104	0.040	0	0.699	0	0	0	0	0	0	0	0	0	0	0
TY-105	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TY-106	.	0	0	0	0	0	0	0	0	0	0	0	0	0
U-101	.	0	0	0	0	0	0	0	0	0	0	0	0	0
U-102	.	0	0	0	0	0	0	0	0	0	0	0	0	0
U-103	.	0	0	0	0	0	0	0	0	0	0	0	0	0
U-104	.	0	0	0	0	0	0	0	0	0	0	0	0	0
U-105	0.404	0	0	0	0	0	0	0	0	0	0	0	0	0.551
U-106	0.679	0	0	0	0	0	0	0	0	0	0	0	0	0
U-107	.	0	0	0	0	0	0	0	0	0	0	0	0	0.313
U-108	0.877	0	0	0	0	0	0	0	0	0	0	0	0	0.346
U-109	0.503	0	0	0	0	0	0	0	0	0	0	0	0	0.614
U-110	0.020	0.093	0	0	0	0	0	0	0	0	0	0	0	0.206
U-111	.	0.028	0	0	0	0	0	0	0	0	0	0	0	0
U-112	.	0.025	0	0	0	0	0	0	0	0	0	0	0	0.452
U-201	.	0	0	0	0	0	0	0	0	0	0	0	0	1
U-202	.	0	0	0	0	0	0	0	0	0	0	0	0	1
U-203	.	0	0	0	0	0	0	0	0	0	0	0	0	1
U-204	.	0	0	0	0	0	0	0	0	0	0	0	0	1
AN-101	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AN-102	.	0	0	0	0	0	1	0	0	0	0	0	0	0
AN-103	0.983	0	0	0	0	0	1	0	0	0	0	0	0	0
AN-104	1.000	0	0	0	0	0	1	0	0	0	0	0	0	0
AN-105	0.977	0	0	0	0	0	1	0	0	0	0	0	0	0
AN-106	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AN-107	.	0	0	0	0	0	1	0	0	0	0	0	0	0
AP-101	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AP-102	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AP-103	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AP-104	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AP-105	.	0	0	0	0	0	1	0	0	0	0	0	0	0
AP-106	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AP-107	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AP-108	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-101	0.930	0	0	0	0	0	1	0	0	0	0	0	0	0
AW-102	.	0	0	0	0	0	0	0	0	0	0	0	1	0
AW-103	.	0	0	0	0	0.721	0	0	0	0	0	0	0	0
AW-104	.	0	0	0	0	0	0.811	0	0	0	0	0	0	0
AW-105	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-106	.	0	0	0	0	0	1	0	0	0	0	0	0	0
AY-101	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AY-102	0.069	0	0	0	0	0	0	0	0	1	0	0	0	0
AZ-101	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AZ-102	0.025	0	0	0	0	0	0	0	0	0	0	0	0	0
SY-101	.	0	0	0	0	0	0	0	0	0	0	0	0	0
SY-102	0.229	0	0	0	0	0	0	0	0	0	0	0	0	0
SY-103	0.090	0	0	0	0	0	0	0	0	0	0	0	0	0

Table C-1. Measured Aluminum Wash Factor and Tank Specific Aluminum Mass Fractions.

Tank	TWF	CWZr	DE	HS	MW	OWW3	P2/P3	PFeCN	PL2	Portland Cement	R-B	R-NB	RSltCk-B	RSltCk-NB
A-101	0.879	0	0	0	0	0	0.044	0	0	0	0	0	0	0
A-102	.	0	0	0	0	0	0	0	0	0	0	0	0	0
A-103	.	0	0	0	0	0	0	0	0	0	0	0	0	0
A-104	.	0	0	0	0	0	0	0	0	0	0	0	0	0
A-105	.	0	0	0	0	0	1	0	0	0	0	0	0	0
A-106	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AX-101	0.948	0	0	0	0	0	0	0	0	0	0	0	0	0
AX-102	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AX-103	.	0	0	0	0	0	0.13	0	0	0	0	0	0	0
AX-104	.	0	0	0	0	0	1	0	0	0	0	0	0	0
B-101	0.250	0	0	0	0	0	0	0	0	0	0	0	0	0
B-102	.	0	0	0	0	0	0	0	0	0	0	0	0	0
B-103	.	0	0	0	0	0	0	0	0	0	0	0	0	0
B-104	0.060	0	0	0	0	0	0	0	0	0	0	0	0	0
B-105	.	0	0	0	0	0	0	0	0	0	0	0	0	0
B-106	0.063	0	0	0	0	0	0	0	0	0	0	0	0	0
B-107	.	0	0	0	0	0	0	0	0	0	0	0	0	0
B-108	0.011	0	0	0	0	0	0	0	0	0	0	0	0	0
B-109	.	0	0	0	0	0	0	0	0	0	0	0	0	0
B-110	0.020	0	0	0	0	0	0.012	0	0	0	0	0	0	0
B-111	0.008	0	0	0	0	0	0.111	0	0	0	0	0	0	0
B-112	.	0	0	0	0	0	0	0	0	0	0	0	0	0
B-201	0.017	0	0	0	0	0	0	0	0	0	0	0	0	0
B-202	0.018	0	0	0	0	0	0	0	0	0	0	0	0	0
B-203	.	0	0	0	0	0	0	0	0	0	0	0	0	0
B-204	.	0	0	0	0	0	0	0	0	0	0	0	0	0
BX-101	.	0	0	0	0	0	0	0	0	0	0	0	0	0
BX-102	.	0	0.015	0	0	0	0	0	0	0	0	0	0	0
BX-103	0.270	0	0	0	0	0	0	0	0	0	0	0	0	0
BX-104	.	0	0	0	0.422	0	0	0	0	0	0	0	0	0
BX-105	0.016	0	0	0	0	0	0	0	0	0	0	0	0	0
BX-106	.	0	0	0	0	0	0	0	0	0	0	0	0	0
BX-107	0.009	0	0	0	0	0	0	0	0	0	0	0	0	0
BX-108	.	0	0	0	0	0	0	0	0	0	0	0	0	0
BX-109	0.095	0	0	0	0	0	0	0	0	0	0	0	0	0
BX-110	0.037	0	0	0	0	0	0	0	0	0	0	0	0	0
BX-111	.	0	0	0	0	0	0	0	0	0	0	0	0	0
BX-112	0.044	0	0	0	0	0	0	0	0	0	0	0	0	0
BY-101	.	0	0	0	0	0	0	0	0	0	0	0	0	0
BY-102	0.720	0	0	0	0	0	0	0	0	0	0	0	0	0
BY-103	.	0	0	0	0	0	0	0	0	0	0	0	0	0
BY-104	0.910	0	0	0	0	0	0	0.317	0	0	0	0	0	0
BY-105	.	0	0	0	0	0	0	0.099	0	0.026	0	0	0	0
BY-106	1.000	0	0	0	0	0	0	0.111	0	0	0	0	0	0
BY-107	0.928	0	0	0	0	0	0	0.089	0	0	0	0	0	0
BY-108	.	0	0	0	0	0	0	0.067	0	0	0	0	0	0
BY-109	.	0	0	0	0	0	0	0	0	0	0	0	0	0
BY-110	0.860	0	0	0	0	0	0	0.205	0	0	0	0	0	0
BY-111	.	0	0	0	0	0	0	0	0	0	0	0	0	0
BY-112	.	0	0	0	0	0	0	0	0	0	0	0	0	0
C-101	.	0	0	0	0	0	0	0	0	0	0	0	0	0
C-102	.	0.028	0	0	0	0	0	0	0	0	0	0	0	0
C-103	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
C-104	0.012	0.09	0	0	0	0.105	0	0	0	0	0	0	0	0
C-105	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
C-106	0.240	0	0	0	0	0	0	0	0	0	0	0	0	0
C-107	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
C-108	0.030	0	0	0	0	0	0	0	0	0	0	0	0	0
C-109	0.002	0	0	0.124	0	0	0	0	0	0	0	0	0	0
C-110	0.084	0	0	0	0	0	0	0	0	0	0	0	0	0
C-111	.	0	0	0.109	0	0	0	0	0	0	0	0	0	0

Table C-1. Measured Aluminum Wash Factor and Tank Specific Aluminum Mass Fractions.

Tank	TWF	CWZr	DE	HS	MW	OWW3	P2/P3	PFeCN	PL2	Portland Cement	R-B	R-NB	RSltCk-B	RSltCk-NB
C-112	0.031	0	0	0	0	0	0	0	0	0	0	0	0	0
C-201	.	0	0	1	0	0	0	0	0	0	0	0	0	0
C-202	.	0	0	1	0	0	0	0	0	0	0	0	0	0
C-203	.	0	0	1	0	0	0	0	0	0	0	0	0	0
C-204	.	0	0	1	0	0	0	0	0	0	0	0	0	0
S-101	0.133	0	0	0	0	0	0	0	0	0	0.416	0	0.14	0
S-102	0.932	0	0	0	0	0	0	0	0	0	0	0.229	0	0
S-103	.	0	0	0	0	0	0	0	0	0	0	0.31	0	0
S-104	0.040	0	0	0	0	0	0	0	0	0	0.431	0	0.474	0
S-105	.	0	0	0	0	0	0	0	0	0	0	0.192	0	0
S-106	.	0	0	0	0	0	0	0	0	0	0	0	0	0
S-107	0.065	0.075	0	0	0	0	0	0	0	0	0.381	0	0	0
S-108	.	0	0	0	0	0	0	0	0	0	0	0.074	0	0
S-109	0.928	0	0	0	0	0	0	0	0	0	0	0.693	0	0
S-110	0.070	0	0	0	0	0	0	0	0	0	0.707	0	0	0
S-111	0.499	0	0	0	0	0	0	0	0	0	0	0.664	0	0
S-112	.	0	0	0	0	0	0	0	0	0	0	0.209	0	0
SX-101	0.974	0	0	0	0	0	0	0	0	0	0	0.386	0	0.319
SX-102	.	0	0	0	0	0	0	0	0	0	0	0.138	0	0
SX-103	0.208	0	0	0	0	0	0	0	0	0	0.702	0	0.037	0
SX-104	.	0	0	0	0	0	0	0	0	0	0.743	0	0.1	0
SX-105	.	0	0	0	0	0	0	0	0	0	0	0.592	0	0
SX-106	.	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-107	.	0	0	0	0	0	0	0	0	0	0.926	0	0.074	0
SX-108	0.163	0	0	0	0	0	0	0	0	0	1	0	0	0
SX-109	.	0	0	0	0	0	0	0	0	0	0.37	0	0.63	0
SX-110	.	0	0	0	0	0	0	0	0	0	0.663	0	0.337	0
SX-111	.	0	0	0	0	0	0	0	0	0	0.83	0	0.17	0
SX-112	.	0	0	0	0	0	0	0	0	0	0.882	0	0.118	0
SX-113	0.000	0	0.62	0	0	0	0	0	0	0	0.38	0	0	0
SX-114	.	0	0	0	0	0	0	0	0	0	0.473	0	0.527	0
SX-115	.	0	0	0	0	0	0	0	0	0	1	0	0	0
T-101	.	0	0	0	0	0	0	0	0	0	0	0	0	0
T-102	0.003	0	0	0	0	0	0	0	0	0	0	0	0	0
T-103	.	0	0	0	0	0	0	0	0	0	0	0	0	0
T-104	0.010	0	0	0	0	0	0	0	0	0	0	0	0	0
T-105	0.003	0	0	0	0	0	0	0	0	0	0	0.286	0	0
T-106	.	0	0	0	0	0	0	0	0	0	0	0	0	0
T-107	0.040	0	0	0	0	0	0	0	0	0	0	0	0	0
T-108	.	0	0	0	0	0	0	0	0	0	0	0	0	0
T-109	.	0	0	0	0	0	0	0	0	0	0	0	0	0
T-110	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
T-111	0.019	0	0	0	0	0	0	0	0	0	0	0	0	0
T-112	.	0	0	0	0	0	0	0	0	0	0	0	0	0
T-201	.	0	0	0	0	0	0	0	0	0	0	0	0	0
T-202	.	0	0	0	0	0	0	0	0	0	0	0	0	0
T-203	.	0	0	0	0	0	0	0	0	0	0	0	0	0
T-204	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-101	.	0	0	0	0	0	0	0	0	0	0	0.962	0	0
TX-102	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-103	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-104	.	0	0	0	0	0	0	0	0	0	0	0.93	0	0
TX-105	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-106	.	0	0	0	0	0	0	0	0	0	0	0.106	0	0
TX-107	.	0	0	0	0	0	0	0	0	0	0	0	0	0.58
TX-108	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-109	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-110	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-111	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-112	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-113	0.428	0	0	0	0	0	0	0	0	0	0	0	0	0

Table C-1. Measured Aluminum Wash Factor and Tank Specific Aluminum Mass Fractions.

Tank	TWF	CWZr	DE	HS	MW	OWW3	P2/P3	PFeCN	PL2	Portland Cement	R-B	R-NB	RSltCk-B	RSltCk-NB
TX-114	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-115	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-116	.	0	0.112	0	0	0	0	0	0	0	0	0	0	0
TX-117	.	0	0.007	0	0	0	0	0	0	0	0	0	0	0
TX-118	0.285	0	0	0	0	0	0	0	0	0	0	0	0	0
TY-101	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TY-102	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TY-103	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TY-104	0.040	0	0	0	0	0	0	0	0	0	0	0	0	0
TY-105	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TY-106	.	0	0.758	0	0	0	0	0	0	0	0	0	0	0
U-101	.	0	0	0	0	0	0	0	0	0	0	1	0	0
U-102	.	0	0	0	0	0	0	0	0	0	0	0.626	0	0
U-103	.	0	0	0	0	0	0	0	0	0	0	0.193	0	0
U-104	.	0	0.01	0	0	0	0	0	0	0	0	0.99	0	0
U-105	0.404	0	0	0	0	0	0	0	0	0	0	0	0	0
U-106	0.679	0	0	0	0	0	0	0	0	0	0	0	0	0
U-107	.	0	0	0	0	0	0	0	0	0	0	0	0	0
U-108	0.877	0	0	0	0	0	0	0	0	0	0	0	0	0
U-109	0.503	0	0	0	0	0	0	0	0	0	0	0	0	0
U-110	0.020	0	0	0	0	0	0	0	0	0	0.701	0	0	0
U-111	.	0	0	0	0	0	0	0	0	0	0	0.317	0	0
U-112	.	0	0	0	0	0	0	0	0	0	0	0.523	0	0
U-201	.	0	0	0	0	0	0	0	0	0	0	0	0	0
U-202	.	0	0	0	0	0	0	0	0	0	0	0	0	0
U-203	.	0	0	0	0	0	0	0	0	0	0	0	0	0
U-204	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AN-101	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AN-102	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AN-103	0.983	0	0	0	0	0	0	0	0	0	0	0	0	0
AN-104	1.000	0	0	0	0	0	0	0	0	0	0	0	0	0
AN-105	0.977	0	0	0	0	0	0	0	0	0	0	0	0	0
AN-106	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AN-107	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AP-101	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AP-102	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AP-103	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AP-104	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AP-105	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AP-106	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AP-107	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AP-108	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-101	0.930	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-102	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-103	.	0.279	0	0	0	0	0	0	0	0	0	0	0	0
AW-104	.	0	0	0	0	0	0	0	0.189	0	0	0	0	0
AW-105	.	0.618	0	0	0	0	0	0	0.382	0	0	0	0	0
AW-106	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AY-101	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AY-102	0.069	0	0	0	0	0	0	0	0	0	0	0	0	0
AZ-101	.	0	0	0	0	0	1	0	0	0	0	0	0	0
AZ-102	0.025	0	0	0	0	0	1	0	0	0	0	0	0	0
SY-101	.	0	0	0	0	0	0	0	0	0	0	0	0	0
SY-102	0.229	0	0	0	0	0	0	0	0	0	0	0	0	0
SY-103	0.090	0	0	0	0	0	0	0	0	0	0	0	0	0

Table C-1. Measured Aluminum Wash Factor and Tank Specific Aluminum Mass Fractions.

Tank	TWF	S1SltCk - B	S1SltCk - NB	S2SltSlr - SST	S2SltSlr - DST	SRR	T1SltCk	T2SltCk	TBP	TFeCN	TH1	TH2	Z	NA
A-101	0.879	0	0	0	0	0	0	0	0	0	0	0	0	0
A-102	.	0	0	0	0	0	0	0	0	0	0	0	0	0
A-103	.	0	0	0	0	0	0	0	0	0	0	0	0	0
A-104	.	0	0	0	0	0	0	0	0	0	0	0	0	0
A-105	.	0	0	0	0	0	0	0	0	0	0	0	0	0
A-106	.	0	0	0	0	0.368	0	0	0	0	0	0	0	0
AX-101	0.948	0	0	0	0	0	0	0	0	0	0	0	0	0
AX-102	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AX-103	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AX-104	.	0	0	0	0	0	0	0	0	0	0	0	0	0
B-101	0.250	0	0	0	0	0	0	0	0	0	0	0	0	0
B-102	.	0	0	0	0	0	0	0	0	0	0	0	0	0
B-103	.	0	0	0	0	0	0	0	0	0	0	0	0	0
B-104	0.060	0	0	0	0	0	0	0	0	0	0	0	0	0
B-105	.	0	0	0	0	0	0	0	0	0	0	0	0	0
B-106	0.063	0	0	0	0	0	0	0	0.161	0	0	0	0	0
B-107	.	0	0	0	0	0	0	0	0	0	0	0	0	0
B-108	0.011	0	0	0	0	0	0	0	0	0	0	0	0	0
B-109	.	0	0	0	0	0	0	0	0	0	0	0	0	0
B-110	0.020	0	0	0	0	0	0	0	0	0	0	0	0	0
B-111	0.008	0	0	0	0	0	0	0	0	0	0	0	0	0
B-112	.	0	0	0	0	0	0	0	0	0	0	0	0	0
B-201	0.017	0	0	0	0	0	0	0	0	0	0	0	0	0
B-202	0.018	0	0	0	0	0	0	0	0	0	0	0	0	0
B-203	.	0	0	0	0	0	0	0	0	0	0	0	0	0
B-204	.	0	0	0	0	0	0	0	0	0	0	0	0	0
BX-101	.	0	0	0	0	0	0	0	0.005	0	0	0	0	0
BX-102	.	0	0	0	0	0	0	0	0	0	0	0	0	0
BX-103	0.270	0	0	0	0	0	0	0	0.011	0	0	0	0	0
BX-104	.	0	0	0	0	0	0	0	0	0	0	0	0	0
BX-105	0.016	0	0	0	0	0	0	0	0.517	0	0	0	0	0
BX-106	.	0	0	0	0	0	0	0	0.5	0	0	0	0	0
BX-107	0.009	0	0	0	0	0	0	0	0	0	0	0	0	0
BX-108	.	0	0	0	0	0	0	0	0.2	0	0	0	0	0
BX-109	0.095	0	0	0	0	0	0	0	1	0	0	0	0	0
BX-110	0.037	0	0	0	0	0	0	0	0	0	0	0	0	0
BX-111	.	0	0	0	0	0	0	0	0	0	0	0	0	0
BX-112	0.044	0	0	0	0	0	0	0	0	0	0	0	0	0
BY-101	.	0	0	0	0	0	0	0	0	0.117	0	0	0	0
BY-102	0.720	0	0	0	0	0	0	0	0	0	0	0	0	0
BY-103	.	0	0	0	0	0	0	0	0	0	0	0	0	0
BY-104	0.910	0	0	0	0	0	0	0	0	0	0	0	0	0
BY-105	.	0	0	0	0	0	0	0	0	0	0	0	0	0
BY-106	1.000	0	0	0	0	0	0	0	0	0	0	0	0	0
BY-107	0.928	0	0	0	0	0	0	0	0	0	0	0	0	0
BY-108	.	0	0	0	0	0	0	0	0	0	0	0	0	0
BY-109	.	0	0	0	0	0	0	0	0	0	0	0	0	0
BY-110	0.860	0	0	0	0	0	0	0	0	0	0	0	0	0
BY-111	.	0	0	0	0	0	0	0	0	0	0	0	0	0
BY-112	.	0	0	0	0	0	0	0	0	0	0	0	0	0
C-101	.	0	0	0	0	0	0	0	0.01	0	0	0	0	0
C-102	.	0	0	0	0	0	0	0	0.002	0	0.023	0	0	0
C-103	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
C-104	0.012	0	0	0	0	0	0	0	0	0	0	0.082	0	0.153
C-105	0.000	0	0	0	0	0	0	0	0.1	0	0	0	0	0
C-106	0.240	0	0	0	0	0	0	0	0	0	0	0	0	0
C-107	0.000	0	0	0	0	0.391	0	0	0	0	0	0	0	0
C-108	0.030	0	0	0	0	0	0	0	0.38	0.18	0	0	0	0
C-109	0.002	0	0	0	0	0	0	0	0	0.429	0	0	0	0
C-110	0.084	0	0	0	0	0	0	0	0	0	0	0	0	0
C-111	.	0	0	0	0	0	0	0	0	0.51	0	0	0	0

Table C-1. Measured Aluminum Wash Factor and Tank Specific Aluminum Mass Fractions.

Tank	TWF	S1SltCk - B	S1SltCk - NB	S2SltSlr - SST	S2SltSlr - DST	SRR	T1SltCk	T2SltCk	TBP	TFeCN	TH1	TH2	Z	NA
C-112	0.031	0	0	0	0	0	0	0	0	0.692	0	0	0	0
C-201	.	0	0	0	0	0	0	0	0	0	0	0	0	0
C-202	.	0	0	0	0	0	0	0	0	0	0	0	0	0
C-203	.	0	0	0	0	0	0	0	0	0	0	0	0	0
C-204	.	0	0	0	0	0	0	0	0	0	0	0	0	0
S-101	0.133	0	0.185	0.127	0	0	0	0	0	0	0	0	0	0
S-102	0.932	0	0.288	0.483	0	0	0	0	0	0	0	0	0	0
S-103	.	0	0.365	0.325	0	0	0	0	0	0	0	0	0	0
S-104	0.040	0	0	0	0	0	0	0	0	0	0	0	0	0
S-105	.	0	0.808	0	0	0	0	0	0	0	0	0	0	0
S-106	.	0	1	0	0	0	0	0	0	0	0	0	0	0
S-107	0.065	0	0	0	0	0	0	0	0	0	0	0	0	0
S-108	.	0	0.926	0	0	0	0	0	0	0	0	0	0	0
S-109	0.928	0	0.307	0	0	0	0	0	0	0	0	0	0	0
S-110	0.070	0.107	0	0	0	0	0	0	0	0	0	0	0	0
S-111	0.499	0	0.21	0	0	0	0	0	0	0	0	0	0	0
S-112	.	0	0.791	0	0	0	0	0	0	0	0	0	0	0
SX-101	0.974	0	0.189	0.107	0	0	0	0	0	0	0	0	0	0
SX-102	.	0	0.78	0.082	0	0	0	0	0	0	0	0	0	0
SX-103	0.208	0.26	0	0	0	0	0	0	0	0	0	0	0	0
SX-104	.	0.157	0	0	0	0	0	0	0	0	0	0	0	0
SX-105	.	0	0.408	0	0	0	0	0	0	0	0	0	0	0
SX-106	.	0	0.181	0.819	0	0	0	0	0	0	0	0	0	0
SX-107	.	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-108	0.163	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-109	.	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-110	.	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-111	.	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-112	.	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-113	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-114	.	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-115	.	0	0	0	0	0	0	0	0	0	0	0	0	0
T-101	.	0	0	0	0	0	0	0.155	0	0	0	0	0	0
T-102	0.003	0	0	0	0	0	0	0	0	0	0	0	0	0
T-103	.	0	0	0	0	0	0	0	0	0	0	0	0	0
T-104	0.010	0	0	0	0	0	0	0	0	0	0	0	0	0
T-105	0.003	0	0	0	0	0	0	0	0	0	0	0	0	0
T-106	.	0	0	0	0	0	0	0	0	0	0	0	0	0
T-107	0.040	0	0	0	0	0	0	0	0.098	0	0	0	0	0
T-108	.	0	0	0	0	0	0.195	0	0	0	0	0	0	0
T-109	.	0	0	0	0	0	1	0	0	0	0	0	0	0
T-110	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
T-111	0.019	0	0	0	0	0	0	0	0	0	0	0	0	0
T-112	.	0	0	0	0	0	0	0	0	0	0	0	0	0
T-201	.	0	0	0	0	0	0	0	0	0	0	0	0	0
T-202	.	0	0	0	0	0	0	0	0	0	0	0	0	0
T-203	.	0	0	0	0	0	0	0	0	0	0	0	0	0
T-204	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-101	.	0	0	0	0	0	0	0.02	0	0	0	0	0.017	0
TX-102	.	0	0	0	0	0	0	1	0	0	0	0	0	0
TX-103	.	0	0	0	0	0	0.002	0.998	0	0	0	0	0	0
TX-104	.	0	0	0	0	0	0	0.07	0	0	0	0	0	0
TX-105	.	0	0	0	0	0	0	1	0	0	0	0	0	0
TX-106	.	0	0	0	0	0	0	0.894	0	0	0	0	0	0
TX-107	.	0	0	0	0	0	0	0.42	0	0	0	0	0	0
TX-108	.	0	0	0	0	0	0	0.995	0.005	0	0	0	0	0
TX-109	.	0	0	0	0	0	0	0	0	0	0	0	0	0
TX-110	.	0	0	0	0	0	0	0.939	0	0	0	0	0	0
TX-111	.	0	0	0	0	0	0	0.909	0	0	0	0	0	0
TX-112	.	0	0	0	0	0	0.003	0.997	0	0	0	0	0	0
TX-113	0.428	0	0	0	0	0	0	1	0	0	0	0	0	0

Table C-1. Measured Aluminum Wash Factor and Tank Specific Aluminum Mass Fractions.

Tank	TWF	S1SltCk - B	S1SltCk - NB	S2SltSlr - SST	S2SltSlr - DST	SRR	T1SltCk	T2SltCk	TBP	TFeCN	TH1	TH2	Z	NA
TX-114	.	0	0	0	0	0	0.009	0.985	0	0	0	0	0	0
TX-115	.	0	0	0	0	0	0	0.998	0.002	0	0	0	0	0
TX-116	.	0	0	0	0	0	0.038	0.85	0	0	0	0	0	0
TX-117	.	0	0	0	0	0	0.052	0.94	0	0	0	0	0	0
TX-118	0.285	0	0	0	0	0	0	0.419	0	0	0	0	0	0.581
TY-101	.	0	0	0	0	0	0.387	0	0	0	0	0	0	0
TY-102	.	0	0	0	0	0	0.451	0.549	0	0	0	0	0	0
TY-103	.	0	0	0	0	0	0	0.29	0.4	0	0	0	0	0
TY-104	0.040	0	0	0	0	0	0	0	0.301	0	0	0	0	0
TY-105	.	0	0	0	0	0	0	0	1	0	0	0	0	0
TY-106	.	0	0	0	0	0	0	0	0.242	0	0	0	0	0
U-101	.	0	0	0	0	0	0	0	0	0	0	0	0	0
U-102	.	0	0	0.12	0	0	0	0.253	0	0	0	0	0	0
U-103	.	0	0.576	0.231	0	0	0	0	0	0	0	0	0	0
U-104	.	0	0	0	0	0	0	0	0	0	0	0	0	0
U-105	0.404	0	0	0.353	0	0	0	0.096	0	0	0	0	0	0
U-106	0.679	0	1	0	0	0	0	0	0	0	0	0	0	0
U-107	.	0	0	0.661	0	0	0	0.027	0	0	0	0	0	0
U-108	0.877	0	0.364	0.29	0	0	0	0	0	0	0	0	0	0
U-109	0.503	0	0.209	0.178	0	0	0	0	0	0	0	0	0	0
U-110	0.020	0	0	0	0	0	0	0	0	0	0	0	0	0
U-111	.	0	0.236	0.42	0	0	0	0	0	0	0	0	0	0
U-112	.	0	0	0	0	0	0	0	0	0	0	0	0	0
U-201	.	0	0	0	0	0	0	0	0	0	0	0	0	0
U-202	.	0	0	0	0	0	0	0	0	0	0	0	0	0
U-203	.	0	0	0	0	0	0	0	0	0	0	0	0	0
U-204	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AN-101	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AN-102	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AN-103	0.983	0	0	0	0	0	0	0	0	0	0	0	0	0
AN-104	1.000	0	0	0	0	0	0	0	0	0	0	0	0	0
AN-105	0.977	0	0	0	0	0	0	0	0	0	0	0	0	0
AN-106	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AN-107	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AP-101	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AP-102	.	0	0	0	0	0	0	0	0	0	0	0	0	1
AP-103	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AP-104	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AP-105	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AP-106	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AP-107	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AP-108	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-101	0.930	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-102	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-103	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-104	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-105	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-106	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AY-101	.	0	0	0	0	0	0	0	0	0	0	0	0	1
AY-102	0.069	0	0	0	0	0	0	0	0	0	0	0	0	0
AZ-101	.	0	0	0	0	0	0	0	0	0	0	0	0	0
AZ-102	0.025	0	0	0	0	0	0	0	0	0	0	0	0	0
SY-101	.	0	0	0	1	0	0	0	0	0	0	0	0	0
SY-102	0.229	0	0	0	0	0	0	0	0	0	0	0	1	0
SY-103	0.090	0	0	0	1	0	0	0	0	0	0	0	0	0

Table C-2. Leach Factor Aluminum Mass Fraction Measured Leach Factors.

Tank	TLF	1C	1CFeCN	224	2C	A1SltCk	A2SltSlr	AR	B	BL	BSltCk	BYSltCk	CWP	CWR	CWZr
A-101	.	0.000	0.000	0.000	0.000	0.593	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A-102	.	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A-103	.	0.000	0.000	0.000	0.000	0.988	0.000	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A-104	.	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A-106	.	0.000	0.000	0.000	0.000	0.040	0.000	0.351	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AX-101	.	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AX-102	.	0.000	0.000	0.000	0.000	0.089	0.000	0.000	0.000	0.911	0.000	0.000	0.000	0.000	0.000
AX-103	.	0.000	0.000	0.000	0.000	0.310	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AX-104	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-101	0.455	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.064	0.286	0.650	0.000	0.000	0.000	0.000
B-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000
B-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000
B-104	0.36	0.338	0.000	0.000	0.505	0.000	0.000	0.000	0.000	0.000	0.157	0.000	0.000	0.000	0.000
B-105	.	0.014	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.984	0.000	0.000	0.000	0.000
B-106	0.742	0.842	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-107	.	0.601	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.332	0.000	0.067	0.000	0.000
B-108	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.235	0.000	0.765	0.000	0.000
B-109	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.143	0.000	0.857	0.000	0.000
B-110	.	0.000	0.000	0.000	0.988	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-111	0.016	0.000	0.000	0.000	0.889	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-112	.	0.000	0.000	0.000	0.573	0.000	0.000	0.000	0.000	0.000	0.000	0.427	0.000	0.000	0.000
B-201	0.208	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-202	0.122	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-203	.	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-204	.	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BX-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.995	0.000	0.000
BX-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.984	0.000	0.000
BX-103	0.97	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.989	0.000	0.000
BX-104	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.140	0.412	0.000
BX-105	0.848	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.485	0.000	0.000
BX-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.502	0.000	0.000
BX-107	0.6	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BX-108	.	0.804	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BX-109	0.698	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BX-110	0.933	0.377	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.623	0.000	0.000	0.000
BX-111	.	0.673	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.327	0.000	0.000	0.000
BX-112	0.953	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.466	0.000	0.000	0.000
BY-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000
BY-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.495	0.505	0.000	0.000
BY-104	0.928	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.745	0.000	0.000	0.000
BY-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-107	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.935	0.000	0.000	0.000
BY-108	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.951	0.000	0.000	0.000
BY-109	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.096	0.904	0.000	0.000
BY-110	0.33	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.844	0.000	0.000	0.000
BY-111	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000
BY-112	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000
C-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.990	0.000	0.000
C-102	0.749	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.950	0.000	0.024
C-103	0.352	0.000	0.000	0.000	0.000	0.000	0.000	0.365	0.000	0.000	0.000	0.000	0.635	0.000	0.000
C-104	0.874	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.607	0.000	0.082
C-105	0.93	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.901	0.000	0.000
C-106	.	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-107	0.623	0.322	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.276	0.000	0.000
C-108	0.762	0.443	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-109	0.632	0.036	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.402	0.000	0.000
C-110	.	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-111	.	0.037	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.335	0.000	0.000
C-112	0.547	0.144	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.159	0.000	0.000

Table C-2. Leach Factor Aluminum Mass Fraction Measured Leach Factors.

Tank	TLF	1C	1CFeCN	224	2C	A1SltCk	A2SltSlr	AR	B	BL	BSltCk	BYSltCk	CWP	CWR	CWZr
C-201	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-202	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-203	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-204	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S-101	0.357	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.169	0.000
S-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S-104	0.469	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.089	0.000
S-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S-107	0.71	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.539	0.068
S-108	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S-109	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S-110	0.49	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.190	0.000
S-111	0.36	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.342	0.000
S-112	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-104	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-107	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-108	0.236	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-109	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-110	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-111	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-112	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-113	0.642	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-114	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-115	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.892	0.000
T-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000
T-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.802	0.198	0.000
T-104	0.474	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-105	.	0.057	0.000	0.000	0.498	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.350	0.000
T-106	.	0.156	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.844	0.000
T-107	0.722	0.856	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.048	0.000	0.000
T-108	.	0.799	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-109	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-110	0.75	0.000	0.000	0.003	0.997	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-111	0.094	0.000	0.000	0.450	0.550	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-112	.	0.000	0.000	0.440	0.560	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-201	.	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-202	.	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-203	.	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-204	.	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-104	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-107	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-108	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-109	.	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-110	.	0.097	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-111	.	0.142	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-112	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-113	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-114	.	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-115	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table C-2. Leach Factor Aluminum Mass Fraction Measured Leach Factors.

Tank	TLF	1C	1CFeCN	224	2C	A1SltCk	A2SltSlr	AR	B	BL	BSltCk	BYSltCk	CWP	CWR	CWZr
TX-116	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-117	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-118	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TY-101	.	0.000	0.606	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TY-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TY-103	.	0.000	0.356	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TY-104	0.48	0.000	0.706	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TY-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TY-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-104	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.897	0.000
U-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-107	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.946	0.000
U-108	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.770	0.000
U-109	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.912	0.000
U-110	0.648	0.098	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.199	0.000
U-111	.	0.164	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-112	.	0.044	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.724	0.000
U-201	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000
U-202	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000
U-203	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000
U-204	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000
AN-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AN-102	.	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AN-103	.	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AN-104	0	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AN-105	.	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AN-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AN-107	.	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AP-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AP-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AP-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AP-104	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AP-105	.	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AP-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AP-107	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AP-108	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AW-101	.	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AW-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000
AW-103	.	0.000	0.000	0.000	0.000	0.173	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.827
AW-104	.	0.000	0.000	0.000	0.000	0.000	0.114	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AW-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.568
AW-106	.	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AY-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AY-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000
AZ-101	0.628	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AZ-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SY-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SY-102	0.746	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SY-103		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table C-2. Leach Factor Aluminum Mass Fraction Measured Leach Factors.

Tank	TLF	DE	HS	MW	OWW3	P2/P3	PFeCN	PL2	Portland Cement	R-B	R-NB	RSltCk - B	RSltCk - NB	S1SltCk -B
A-101	.	0.000	0.000	0.000	0.000	0.407	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A-104	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A-105	.	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AX-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AX-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AX-103	.	0.000	0.000	0.000	0.000	0.690	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AX-104	.	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-101	0.455	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-104	0.36	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-106	0.742	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-107	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-108	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-109	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-110	.	0.000	0.000	0.000	0.000	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-111	0.016	0.000	0.000	0.000	0.000	0.111	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-112	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-201	0.208	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-202	0.122	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-203	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-204	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BX-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BX-102	.	0.016	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BX-103	0.97	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BX-104	.	0.000	0.000	0.448	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BX-105	0.848	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BX-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BX-107	0.6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BX-108	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BX-109	0.698	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BX-110	0.933	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BX-111	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BX-112	0.953	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-104	0.928	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-105	.	0.000	0.000	0.000	0.000	0.000	0.060	0.000	0.195	0.000	0.000	0.000	0.000	0.000
BY-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-107	.	0.000	0.000	0.000	0.000	0.000	0.065	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-108	.	0.000	0.000	0.000	0.000	0.000	0.049	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-109	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-110	0.33	0.000	0.000	0.000	0.000	0.000	0.156	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-111	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-112	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-102	0.749	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-103	0.352	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-104	0.874	0.000	0.000	0.000	0.096	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-105	0.93	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-107	0.623	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-108	0.762	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-109	0.632	0.000	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-110	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-111	.	0.000	0.112	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table C-2. Leach Factor Aluminum Mass Fraction Measured Leach Factors.

Tank	TLF	DE	HS	MW	OWW3	P2/P3	PFeCN	PL2	Portland Cement	R-B	R-NB	RSltCk - B	RSltCk - NB	S1SltCk -B
C-112	0.547	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-201	.	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-202	.	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-203	.	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-204	.	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S-101	0.357	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.558	0.000	0.205	0.000	0.000
S-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.437	0.000	0.000	0.000
S-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.453	0.000	0.000	0.000
S-104	0.469	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.415	0.000	0.497	0.000	0.000
S-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.188	0.000	0.000	0.000
S-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S-107	0.71	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.393	0.000	0.000	0.000	0.005
S-108	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.072	0.000	0.000	0.000
S-109	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.688	0.000	0.000	0.000
S-110	0.49	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.748	0.000	0.000	0.000	0.062
S-111	0.36	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.497	0.000	0.000	0.000
S-112	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.205	0.000	0.000	0.000
SX-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.666	0.000	0.000	0.000
SX-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.147	0.000	0.000	0.000
SX-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.794	0.000	0.046	0.000	0.161
SX-104	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.792	0.000	0.116	0.000	0.092
SX-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.586	0.000	0.000	0.000
SX-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-107	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.920	0.000	0.080	0.000	0.000
SX-108	0.236	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000
SX-109	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.350	0.000	0.650	0.000	0.000
SX-110	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.644	0.000	0.356	0.000	0.000
SX-111	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.818	0.000	0.182	0.000	0.000
SX-112	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.873	0.000	0.127	0.000	0.000
SX-113	0.642	0.640	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.360	0.000	0.000	0.000	0.000
SX-114	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.452	0.000	0.548	0.000	0.000
SX-115	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000
T-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-104	0.474	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.095	0.000	0.000	0.000
T-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-107	0.722	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-108	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-109	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-110	0.75	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-111	0.094	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-112	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-201	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-202	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-203	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-204	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.905	0.000	0.000	0.000
TX-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-104	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.848	0.000	0.000	0.000
TX-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.048	0.000	0.000	0.000
TX-107	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-108	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-109	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-110	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-111	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-112	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-113	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table C-2. Leach Factor Aluminum Mass Fraction Measured Leach Factors.

Tank	TLF	DE	HS	MW	OWW3	P2/P3	PFeCN	PL2	Portland Cement	R-B	R-NB	RSltCk - B	RSltCk - NB	S1SltCk -B
TX-114	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-115	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-116	.	0.174	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-117	.	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-118	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TY-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TY-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TY-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TY-104	0.48	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TY-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TY-106	.	0.769	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000
U-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.510	0.000	0.000	0.000
U-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.247	0.000	0.000	0.000
U-104	.	0.040	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.960	0.000	0.000	0.000
U-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-107	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-108	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-109	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-110	0.648	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.703	0.000	0.000	0.000	0.000
U-111	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.474	0.000	0.000	0.000
U-112	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.233	0.000	0.000	0.000
U-201	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-202	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-203	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-204	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AN-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AN-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AN-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AN-104	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AN-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AN-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AN-107	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AP-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AP-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AP-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AP-104	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AP-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AP-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AP-107	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AP-108	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AW-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AW-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AW-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AW-104	.	0.000	0.000	0.000	0.000	0.000	0.000	0.886	0.000	0.000	0.000	0.000	0.000	0.000
AW-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.432	0.000	0.000	0.000	0.000	0.000	0.000
AW-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AY-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AY-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AZ-101	0.628	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AZ-102	.	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SY-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SY-102	0.746	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SY-103		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table C-2. Leach Factor Aluminum Mass Fraction Measured Leach Factors.

Tank	TLF	S1SltCk-NB	S2SltSlr-SST	S2SltSlr-DST	SRR	T1SltCk	T2SltCk	TBP	TFeCN	TH1	TH2	Z	NA
A-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A-104	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A-106	.	0.000	0.000	0.000	0.609	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AX-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AX-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AX-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AX-104	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-101	*0.455*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
B-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-104	0.36	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-106	0.742	0.000	0.000	0.000	0.000	0.000	0.000	0.158	0.000	0.000	0.000	0.000	0.000
B-107	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-108	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-109	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-110	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-111	0.016	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-112	.	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
B-201	0.208	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-202	0.122	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-203	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B-204	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BX-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000
BX-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BX-103	0.97	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.000	0.000	0.000	0.000	0.000
BX-104	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BX-105	0.848	0.000	0.000	0.000	0.000	0.000	0.000	0.515	0.000	0.000	0.000	0.000	0.000
BX-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.498	0.000	0.000	0.000	0.000	0.000
BX-107	*0.6*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
BX-108	.	0.000	0.000	0.000	0.000	0.000	0.000	0.196	0.000	0.000	0.000	0.000	0.000
BX-109	0.698	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000
BX-110	0.933	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BX-111	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BX-112	0.953	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.534	0.000	0.000	0.000	0.000
BY-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-104	0.928	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-106	.	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
BY-107	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-108	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-109	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-110	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-111	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BY-112	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-101	0.749	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.000
C-102	0.352	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.024	0.000	0.000	0.000
C-103	0.874	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-104	0.93	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.075	0.000	0.140
C-105	.	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.099*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
C-106	0.623	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-107	0.762	0.000	0.000	0.000	0.402	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-108	0.632	0.000	0.000	0.000	0.000	0.000	0.000	0.373	0.184	0.000	0.000	0.000	0.000
C-109	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.434	0.000	0.000	0.000	0.000
C-110	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-111	0.547	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.515	0.000	0.000	0.000	0.000

Table C-2. Leach Factor Aluminum Mass Fraction Measured Leach Factors.

Tank	TLF	S1SltCk-NB	S2SltSlr-SST	S2SltSlr-DST	SRR	T1SltCk	T2SltCk	TBP	TFeCN	TH1	TH2	Z	NA
C-112	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.698	0.000	0.000	0.000	0.000
C-201	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-202	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-203	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C-204	0.357	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S-101	.	0.068	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S-102	.	0.563	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S-103	0.469	0.547	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S-104	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S-105	.	0.812	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S-106	0.71	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S-107	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S-108	.	0.928	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S-109	*0.49*	*0.312*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
S-110	0.36	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S-111	.	0.161	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S-112	.	0.795	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-101	.	0.334	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-102	.	0.853	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-104	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-105	.	0.414	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-107	0.236	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-108	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-109	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-110	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-111	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-112	0.642	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-113	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-114	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SX-115	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-101	.	0.000	0.000	0.000	0.000	0.000	0.108	0.000	0.000	0.000	0.000	0.000	0.000
T-102	0.474	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-104	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-105	0.722	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-107	.	0.000	0.000	0.000	0.000	0.000	0.000	0.096	0.000	0.000	0.000	0.000	0.000
T-108	0.75	0.000	0.000	0.000	0.000	0.201	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-109	0.094	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-110	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-111	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-112	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-201	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-202	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-203	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-204	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-101	.	0.000	0.000	0.000	0.000	0.000	0.045	0.000	0.000	0.000	0.000	0.050	0.000
TX-102	.	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-103	.	*0.000*	*0.000*	*0.000*	*0.000*	*0.003*	*0.997*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
TX-104	.	0.000	0.000	0.000	0.000	0.000	0.152	0.000	0.000	0.000	0.000	0.000	0.000
TX-105	.	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-106	.	0.000	0.000	0.000	0.000	0.000	0.952	0.000	0.000	0.000	0.000	0.000	0.000
TX-107	.	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-108	.	0.000	0.000	0.000	0.000	0.000	0.992	0.008	0.000	0.000	0.000	0.000	0.000
TX-109	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TX-110	.	0.000	0.000	0.000	0.000	0.000	0.903	0.000	0.000	0.000	0.000	0.000	0.000
TX-111	.	0.000	0.000	0.000	0.000	0.000	0.858	0.000	0.000	0.000	0.000	0.000	0.000
TX-112	.	0.000	0.000	0.000	0.000	0.005	0.995	0.000	0.000	0.000	0.000	0.000	0.000
TX-113	.	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000

Table C-2. Leach Factor Aluminum Mass Fraction Measured Leach Factors.

Tank	TLF	S1SltCk-NB	S2SltSlr-SST	S2SltSlr-DST	SRR	T1SltCk	T2SltCk	TBP	TFeCN	TH1	TH2	Z	NA
TX-114	.	0.000	0.000	0.000	0.000	0.015	0.975	0.000	0.000	0.000	0.000	0.000	0.000
TX-115	.	0.000	0.000	0.000	0.000	0.000	0.997	0.003	0.000	0.000	0.000	0.000	0.000
TX-116	.	0.000	0.000	0.000	0.000	0.059	0.768	0.000	0.000	0.000	0.000	0.000	0.000
TX-117	.	0.000	0.000	0.000	0.000	0.086	0.903	0.000	0.000	0.000	0.000	0.000	0.000
TX-118	.	0.000	0.000	0.000	0.000	0.000	0.342	0.000	0.000	0.000	0.000	0.000	0.658
TY-101	.	0.000	0.000	0.000	0.000	0.394	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TY-102	0.48	0.000	0.000	0.000	0.000	0.585	0.415	0.000	0.000	0.000	0.000	0.000	0.000
TY-103	.	0.000	0.000	0.000	0.000	0.000	0.200	0.444	0.000	0.000	0.000	0.000	0.000
TY-104	.	0.000	0.000	0.000	0.000	0.000	0.000	0.294	0.000	0.000	0.000	0.000	0.000
TY-105	.	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000
TY-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.231	0.000	0.000	0.000	0.000	0.000
U-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-102	.	0.000	0.000	0.000	0.000	0.000	0.490	0.000	0.000	0.000	0.000	0.000	0.000
U-103	.	0.753	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-104	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-105	.	0.000	0.000	0.000	0.000	0.000	0.103	0.000	0.000	0.000	0.000	0.000	0.000
U-106	.	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-107	.	0.000	0.000	0.000	0.000	0.000	0.054	0.000	0.000	0.000	0.000	0.000	0.000
U-108	0.648	0.230	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-109	.	0.088	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-110	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-111	.	0.361	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-112	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-201	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-202	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-203	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U-204	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AN-101	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AN-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AN-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AN-104	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AN-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AN-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AN-107	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AP-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AP-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000
AP-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AP-104	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AP-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AP-106	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AP-107	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AP-108	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AW-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AW-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AW-103	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AW-104	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AW-105	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AW-106	0.628	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AY-101	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000
AY-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AZ-101	0.746	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AZ-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SY-101	.	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SY-102	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000
SY-103	.	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

The matrices in Tables C-1 and C-2 were used to create the matrix model shown in Equation C-2. The vector B represents the waste type estimates and their associated standard errors. Because the sample data is not perfect, and the proportions used in the model equation are also not perfect, the estimates, for some cases, did not reflect reality. That is, they were estimated as negative or above 1. In each case, the cause was investigated, and was usually attributed to one of the following reasons:

1) The waste type was represented by only 1 tank, and was a small proportion of that tank
2) The waste type was part of 1 or more tanks where each tank had 3 or more waste types in it
3) Two waste types were found in the same sample, and only in that sample, and therefore became linear combinations of one another, creating bias in the estimate

Each case was evaluated and a decision made. In most cases, the estimate was close to zero or one, and was therefore considered zero or one, respectively. For those waste types where no data was available, a collective mean and standard deviation was derived from the estimates of all the other tanks where data was available, and used as the estimate for that waste type. Sludges and saltcakes were separated for the collective estimates. Tables C-3 and C-4 show the waste type estimates for wash and leach factors, respectively. In Tables C-3 and C-4, the left-most 3 columns are the fitted model estimates, the middle 3 columns are the calculated collective estimates for sludge and saltcake, respectively, and the right-most 3 columns are the final estimates used in the model. Note that some of the standard errors are unavailable. These occur when the estimate was changed to zero or 1 to reflect reality, and therefore the estimate and its standard error cannot be estimated.

Once the model is formed (Equation C-2), the tank factor predictions can be implemented, and their standard errors calculated. Note that for some of the predictions, no estimate of uncertainty will be derived, as that tank may have used a waste type that had been changed to zero or one.

Table C-3 Aluminum Wash Factor Waste Type Estimates

Waste	Est	Std Error	Comment	collective	mean	sd	Waste	Final Est	Std Error
1C	0.021	0.061		sludge	0.119	0.200	1C	0.021	0.061
1CFeCN	0.029	0.214		saltcake	0.623	0.307	1CFeCN	0.029	0.214
224	0.018	0.098					224	0.018	0.098
2C	0.018	0.081					2C	0.018	0.081
A1SltCk	0.934	0.105					A1SltCk	0.934	0.105
A2SltSlr	0.973	0.073					A2SltSlr	0.973	0.073
AR	-0.112	0.380	estimate as 0				AR	0.000	0.000
B	*3.468*	*5.162*	*estimate as 1*				B	*1.000*	*0.000*
BL	0.069	0.145					BL	0.069	0.145
BSltCk	-0.054	0.577	estimate as 0				BSltCk	0.000	0.000
BYSltCk	0.621	0.093					BYSltCk	0.621	0.093
CWP	0.076	0.082					CWP	0.076	0.082
CWR	0.103	0.202					CWR	0.103	0.202
CWZr	-0.174	2.419	estimate as 0				CWZr	0.000	0.000
DE	-0.035	0.244	estimate as 0				DE	0.000	0.000
HS	-0.309	1.384	estimate as 0				HS	0.000	0.000
MW	0.000	0.000	collective-no data				MW	0.119	0.200
OWW3	-0.423	2.559	estimate as 0				OWW3	0.000	0.000
P2/P3	0.023	0.144					P2/P3	0.023	0.144
PFeCN	1.910	0.480	estimate as 1				PFeCN	1.000	0.000
PL2	0.000	0.000	collective-no data				PL2	0.119	0.200
Portland Cement	0.000	0.000	collective-no data				Portland Cement	0.119	0.200
R-B	0.058	0.113					R-B	0.058	0.113
R-NB	0.754	0.157					R-NB	0.754	0.157
RSltCk-B	-0.098	0.316	estimate as 0				RSltCk-B	0.000	0.000
RSltCk-NB	1.298	0.493	estimate as 1				RSltCk-NB	1.000	0.000
S1SltCk-B	0.576	0.624					S1SltCk-B	0.576	0.624
S1SltCk-NB	0.751	0.138					S1SltCk-NB	0.751	0.138
S2SltSlr-SST	1.189	0.279	estimate as 1				S2SltSlr-SST	1.000	0.000
S2SltSlr-DST	0.090	0.145					S2SltSlr-DST	0.090	0.145
SRR	-0.072	0.380	estimate as 0				SRR	0.000	0.000
T1SltCk	0.000	0.000	collective-no data				T1SltCk	0.623	0.307
T2SltCk	0.417	0.145					T2SltCk	0.417	0.145
TBP	0.066	0.123					TBP	0.066	0.123
TFeCN	*0.020*	*0.205*					*TFeCN*	*0.020*	*0.205*
TH1	-2.732	7.740	estimate as 0				TH1	0.000	0.000
TH2	0.000	0.000	collective-no data				TH2	0.119	0.200
Z	0.229	0.145					Z	0.229	0.145
NA	0.190	0.271					NA	0.190	0.271

Table C-4. Aluminum Leach Factor Waste Type Estimates

Waste	Est	Std Error	Comment		mean	sd	Waste	Final Est	Std Error
1C	0.700	0.101		sludge	0.517	0.281	1C	0.700	0.101
1CFeCN	0.372	0.313		saltcake	0.374	0.373	1CFeCN	0.372	0.313
224	0.131	0.146					224	0.131	0.146
2C	0.346	0.150					2C	0.346	0.150
A1SltCk	0.000	0.000	collective-no data				A1SltCk	0.374	0.373
A2SltSlr	0.000	0.215					A2SltSlr	0.000	0.215
AR	0.000	0.000	collective-no data				AR	0.517	0.281
B	10.441	15.254	estimate as 1				B	1.000	---
BL	0.000	0.000	estimate as 0				BL	0.000	---
BSltCk	-0.328	1.465	estimate as 0				BSltCk	0.000	---
BYSltCk	1.074	0.350	estimate as 1				BYSltCk	1.000	---
CWP	0.961	0.154					CWP	0.961	0.154
CWR	2.078	1.319	estimate as 1				CWR	1.000	---
CWZr	-7.297	10.100	estimate as 0				CWZr	0.000	---
DE	0.870	0.356					DE	0.870	0.356
HS	0.178	1.997					HS	0.178	1.997
MW	0.000	0.000	collective no data				MW	0.517	0.281
OWW3	0.000	0.000	collective-no data				OWW3	0.517	0.281
P2/P3	0.588	0.214					P2/P3	0.588	0.214
PFeCN	0.928	0.215					PFeCN	0.928	0.215
PL2	0.000	0.000	collective-no data				PL2	0.517	0.281
Portland Cement	0.000	0.000	collective-no data				Portland Cement	0.517	0.281
R-B	0.236	0.215					R-B	0.236	0.215
R-NB	0.000	0.000	collective-no data				R-NB	0.517	0.281
RSltCk-B	0.375	0.475					RSltCk-B	0.375	0.475
RSltCk-NB	0.000	0.000	collective-no data				RSltCk-NB	0.374	0.373
S1SltCk-B	-1.312	4.794	estimate as 0				S1SltCk-B	0.000	---
S1SltCk-NB	0.000	0.000	collective-no data				S1SltCk-NB	0.374	0.373
S2SltSlr-SST	0.000	0.000	collective-no data				S2SltSlr-SST	0.374	0.373
S2SltSlr-DST	0.746	0.215					S2SltSlr-DST	0.746	0.215
SRR	0.329	0.550					SRR	0.329	0.550
T1SltCk	0.000	0.000	collective-no data				T1SltCk	0.374	0.373
T2SltCk	0.000	0.000	collective-no data				T2SltCk	0.374	0.373
TBP	0.739	0.184					TBP	0.739	0.184
TFeCN	0.455	0.301					TFeCN	0.455	0.301
TH1	0.397	14.798					TH1	0.397	14.798
TH2	0.000	0.000	collective-no data				TH2	0.517	0.281
Z	0.000	0.000	collective-no data				Z	0.517	0.281
NA	0.000	0.000	collective-no data				NA	0.517	0.281

Table C-5. Aluminum Wash Predicted TWFs and Uncertainties

Tank	TWF	Pred TWF	Std Err	Lower	Upper
A-101	0.879	0.894	0.100	0.532	1.255
A-102	.	0.934	0.105	0.567	1.301
A-103	.	0.933	0.105	0.566	1.299
A-104	.	0.000	---	---	---
A-105	.	0.023	0.144	-0.396	0.442
A-106	.	0.344	---	---	---
AX-101	0.948	0.934	0.105	0.567	1.301
AX-102	.	0.572	0.086	0.227	0.918
AX-103	.	0.815	0.093	0.463	1.168
AX-104	.	0.023	0.144	-0.396	0.442
B-101	0.250	0.096	---	---	---
B-102	.	0.000	---	---	---
B-103	.	0.000	---	---	---
B-104	0.060	0.016	---	---	---
B-105	.	0.000	---	---	---
B-106	0.063	0.028	0.053	-0.288	0.344
B-107	.	0.018	---	---	---
B-108	0.011	0.059	---	---	---
B-109	.	0.065	---	---	---
B-110	0.020	0.019	0.080	-0.321	0.358
B-111	0.008	0.019	0.073	-0.314	0.352
B-112	.	0.540	0.081	0.200	0.880
B-201	0.017	0.018	0.098	-0.341	0.377
B-202	0.018	0.018	0.098	-0.341	0.377
B-203	.	0.018	0.098	-0.341	0.377
B-204	.	0.018	0.098	-0.341	0.377
BX-101	.	0.076	0.082	-0.266	0.417
BX-102	.	0.074	0.081	-0.267	0.414
BX-103	0.270	0.075	0.081	-0.265	0.416
BX-104	.	0.106	---	---	---
BX-105	0.016	0.070	0.069	-0.259	0.400
BX-106	.	0.071	0.068	-0.258	0.399
BX-107	0.009	0.021	0.061	-0.302	0.343
BX-108	.	0.030	0.052	-0.286	0.345
BX-109	0.095	0.066	0.123	-0.324	0.455
BX-110	0.037	0.507	0.076	0.172	0.842
BX-111	.	0.504	0.075	0.169	0.839
BX-112	0.018	0.021	0.061	-0.302	0.343
BY-101	.	0.551	0.085	0.206	0.896
BY-102	0.720	0.621	0.093	0.269	0.974
BY-103	.	0.562	0.083	0.219	0.904
BY-104	0.910	0.741	---	---	---
BY-105	.	0.646	---	---	---
BY-106	1.000	0.663	---	---	---
BY-107	0.928	0.655	---	---	---
BY-108	.	0.647	---	---	---
BY-109	.	0.333	0.062	0.010	0.655
BY-110	0.860	0.699	---	---	---
BY-111	.	0.621	0.093	0.269	0.974
BY-112	.	0.621	0.093	0.269	0.974
C-101	.	0.075	0.081	-0.265	0.416
C-102	0.004	0.072	---	---	---
C-103	0.000	0.045	---	---	---
C-104	0.012	0.082	---	---	---
C-105	0.000	0.075	0.073	-0.258	0.407
C-106	-	0.000	---	---	---
C-107	0.000	0.028	---	---	---
C-108	0.030	0.038	0.060	-0.284	0.359
C-109	0.002	0.040	---	---	---
C-110	0.084	0.021	0.061	-0.302	0.343
C-111	.	0.037	---	---	---
TX-114	.	0.417	---	---	---

Tank	TWF	Pred TWF	Std Err	Lower	Upper
C-112	0.031	0.029	---	---	---
C-201	.	0.000	---	---	---
C-202	.	0.000	---	---	---
C-203	.	0.000	---	---	---
C-204	.	0.000	---	---	---
S-101	0.133	0.303	---	---	---
S-102	0.932	0.872	---	---	---
S-103	.	0.833	---	---	---
S-104	0.040	0.035	---	---	---
S-105	.	0.751	0.106	0.384	1.119
S-106	.	0.751	0.138	0.341	1.161
S-107	0.065	0.078	---	---	---
S-108	.	0.751	0.124	0.359	1.142
S-109	0.928	0.753	0.104	0.388	1.118
S-110	0.070	0.122	0.073	-0.211	0.454
S-111	0.499	0.671	0.103	0.307	1.035
S-112	.	0.751	0.103	0.386	1.116
SX-101	0.974	0.859	---	---	---
SX-102	.	0.771	---	---	---
SX-103	0.208	0.190	---	---	---
SX-104	.	0.133	---	---	---
SX-105	.	0.752	0.092	0.401	1.104
SX-106	.	0.955	---	---	---
SX-107	.	0.054	---	---	---
SX-108	0.163	0.058	0.113	-0.319	0.435
SX-109	.	0.021	---	---	---
SX-110	.	0.038	---	---	---
SX-111	.	0.048	---	---	---
SX-112	.	0.051	---	---	---
SX-113	0.000	0.022	---	---	---
SX-114	.	0.027	---	---	---
SX-115	.	0.058	0.113	-0.319	0.435
T-101	.	0.152	0.171	-0.308	0.612
T-102	0.003	0.076	0.082	-0.266	0.417
T-103	.	0.081	0.077	-0.256	0.418
T-104	0.010	0.021	0.061	-0.302	0.343
T-105	-	0.254	0.081	-0.087	0.594
T-106	.	0.091	0.173	-0.371	0.553
T-107	0.040	0.028	0.052	-0.288	0.344
T-108	.	0.138	---	---	---
T-109	.	0.623	---	---	---
T-110	0.000	0.018	0.081	-0.322	0.359
T-111	0.019	0.018	0.060	-0.303	0.340
T-112	.	0.018	0.060	-0.303	0.340
T-201	.	0.018	0.098	-0.341	0.377
T-202	.	0.018	0.098	-0.341	0.377
T-203	.	0.018	0.098	-0.341	0.377
T-204	.	0.018	0.098	-0.341	0.377
TX-101	.	0.737	0.152	0.308	1.167
TX-102	.	0.417	0.145	-0.003	0.837
TX-103	.	0.418	---	---	---
TX-104	.	0.730	0.147	0.307	1.153
TX-105	.	0.417	0.145	-0.003	0.837
TX-106	.	0.453	0.130	0.053	0.853
TX-107	.	0.755	---	---	---
TX-108	.	0.415	0.144	-0.003	0.834
TX-109	.	0.021	0.061	-0.302	0.343
TX-110	.	0.393	0.136	-0.014	0.800
TX-111	.	0.381	0.132	-0.020	0.782
TX-112	.	0.418	---	---	---
TX-113	0.428	0.417	0.145	-0.003	0.837
AN-101	.	0.000	.	.	.

Table C-5. Aluminum Wash Predicted TWFs and Uncertainties

Tank	TWF	Pred TWF	Std Err	Lower	Upper
TX-115	.	0.417	0.144	-0.003	0.836
TX-116	.	0.378	---	---	---
TX-117	.	0.425	---	---	---
TX-118	0.285	0.285	0.145	-0.135	0.705
TY-101	.	0.259	---	---	---
TY-102	.	0.510	---	---	---
TY-103	.	0.156	0.084	-0.187	0.499
TY-104	0.040	0.040	0.145	-0.380	0.460
TY-105	.	0.066	0.123	-0.324	0.455
TY-106	.	0.016	---	---	---
U-101	.	0.754	0.157	0.315	1.192
U-102	.	0.697	---	---	---
U-103	.	0.809	---	---	---
U-104	.	0.746	0.156	0.310	1.182
U-105	0.404	0.450	---	---	---
U-106	0.679	0.751	0.138	0.341	1.161
U-107	.	0.704	---	---	---
U-108	0.877	0.599	---	---	---
U-109	0.503	0.398	---	---	---
U-110	0.020	0.064	0.081	-0.277	0.404
U-111	.	0.837	---	---	---
U-112	.	0.441	0.125	0.049	0.833
U-201	.	0.103	0.202	-0.406	0.612
U-202	.	0.103	0.202	-0.406	0.612
U-203	.	0.103	0.202	-0.406	0.612
U-204	.	0.103	0.202	-0.406	0.612

Tank	TWF	Pred TWF	Std Err	Lower	Upper
AN-102	.	0.973	0.073	0.640	1.305
AN-103	0.983	0.973	0.073	0.640	1.305
AN-104	1.000	0.973	0.073	0.640	1.305
AN-105	0.977	0.973	0.073	0.640	1.305
AN-106	.	0.000	.	.	.
AN-107	.	0.973	0.073	0.640	1.305
AP-101	.	0.000	.	.	.
AP-102	.	0.190	0.271	-0.439	0.819
AP-103	.	0.000	.	.	.
AP-104	.	0.000	.	.	.
AP-105	.	0.973	0.073	0.640	1.305
AP-106	.	0.000	.	.	.
AP-107	.	0.000	.	.	.
AP-108	.	0.000	.	.	.
AW-101	0.930	0.973	0.073	0.640	1.305
AW-102	.	0.076	0.082	-0.266	0.417
AW-103	.	0.673	---	---	---
AW-104	.	0.811	---	---	---
AW-105	.	0.046	---	---	---
AW-106	.	0.973	0.073	0.640	1.305
AY-101	.	0.190	0.271	-0.439	0.819
AY-102	0.069	0.069	0.145	-0.351	0.489
AZ-101	.	0.023	0.144	-0.396	0.442
AZ-102	0.025	0.023	0.144	-0.396	0.442
SY-101	.	0.090	0.145	-0.330	0.510
SY-102	0.229	0.229	0.145	-0.191	0.649
SY-103	0.090	0.090	0.145	-0.330	0.510

Table C-6. Aluminum Leach Factor Predictions and Uncertainties

Tank	TLF	Pred TLF	Std Err	Lower	Upper
A-101	.	0.461	---	---	---
A-102	.	0.374	---	---	---
A-103	.	0.375	---	---	---
A-104	.	0.517	---	---	---
A-105	.	0.588	0.214	-0.086	1.263
A-106	.	0.397	---	---	---
AX-101	.	0.374	---	---	---
AX-102	.	0.033	---	---	---
AX-103	.	0.522	---	---	---
AX-104	.	0.588	0.214	-0.086	1.263
B-101	0.455	0.064	---	---	---
B-102	.	0.000	---	---	---
B-103	.	0.000	---	---	---
B-104	0.36	0.411	---	---	---
B-105	.	0.011	---	---	---
B-106	0.742	0.706	0.086	0.191	1.221
B-107	.	0.485	---	---	---
B-108	.	0.735	---	---	---
B-109	.	0.824	---	---	---
B-110	.	0.349	0.148	-0.231	0.930
B-111	0.016	0.373	0.134	-0.190	0.937
B-112	.	0.625	---	---	---
B-201	0.208	0.131	0.146	-0.447	0.708
B-202	0.122	0.131	0.146	-0.447	0.708
B-203	.	0.131	0.146	-0.447	0.708
B-204	.	0.131	0.146	-0.447	0.708
BX-101	.	0.960	0.153	0.373	1.547
BX-102	.	0.960	0.151	0.375	1.545
BX-103	0.97	0.959	0.152	0.373	1.544
BX-104	.	0.778	---	---	---
BX-105	0.848	0.847	0.108	0.311	1.382
BX-106	.	0.850	0.107	0.316	1.385
BX-107	0.6	0.700	0.101	0.172	1.228
BX-108	.	0.708	0.084	0.194	1.221
BX-109	0.698	0.739	0.184	0.109	1.369
BX-110	0.933	0.887	---	---	---
BX-111	.	0.798	---	---	---
BX-112	0.953	0.700	0.101	0.172	1.228
BY-101	.	0.709	---	---	---
BY-102	.	1.000	---	---	---
BY-103	.	0.980	---	---	---
BY-104	0.928	0.928	0.215	0.252	1.604
BY-105	.	0.901	---	---	---
BY-106	.	0.000	---	---	---
BY-107	.	0.995	---	---	---
BY-108	.	0.996	---	---	---
BY-109	.	0.965	---	---	---
BY-110	-	0.989	---	---	---
BY-111	.	1.000	---	---	---
BY-112	.	1.000	---	---	---
C-101	.	0.959	0.152	0.373	1.545
C-102	0.749	0.924	---	---	---
C-103	-	0.799	---	---	---
C-104	-	0.744	---	---	---
C-105	0.93	0.939	0.136	0.373	1.505
C-106	-	0.517	---	---	---
C-107	0.623	0.623	0.215	-0.053	1.299
C-108	0.762	0.669	0.090	0.151	1.188
C-109	0.632	0.632	0.215	-0.044	1.308
C-110	.	0.700	0.101	0.172	1.228
C-111	.	0.603	---	---	---

Tank	TLF	Pred TLF	Std Err	Lower	Upper
C-112	0.547	0.571	0.208	-0.095	1.238
C-201	.	0.178	1.997	-4.296	4.653
C-202	.	0.178	1.997	-4.296	4.653
C-203	.	0.178	1.997	-4.296	4.653
C-204	.	0.178	1.997	-4.296	4.653
S-101	0.357	0.403	---	---	---
S-102	.	0.436	---	---	---
S-103	.	0.438	---	---	---
S-104	0.469	0.373	---	---	---
S-105	.	0.400	---	---	---
S-106	.	0.374	---	---	---
S-107	0.71	0.632	---	---	---
S-108	.	0.384	---	---	---
S-109	.	0.472	---	---	---
S-110	0.49	0.367	---	---	---
S-111	0.36	0.659	---	---	---
S-112	.	0.403	---	---	---
SX-101	.	0.469	---	---	---
SX-102	.	0.395	---	---	---
SX-103	.	0.204	---	---	---
SX-104	.	0.230	---	---	---
SX-105	.	0.457	---	---	---
SX-106	.	0.000	---	---	---
SX-107	.	0.247	0.198	-0.403	0.897
SX-108	0.236	0.236	0.215	-0.440	0.912
SX-109	.	0.326	0.311	-0.516	1.168
SX-110	.	0.285	0.208	-0.381	0.952
SX-111	.	0.261	0.188	-0.375	0.897
SX-112	.	0.254	0.191	-0.387	0.894
SX-113	0.642	0.642	0.215	-0.034	1.318
SX-114	.	0.312	0.269	-0.455	1.079
SX-115	.	0.236	0.215	-0.440	0.912
T-101	.	0.932	---	---	---
T-102	.	0.961	0.154	0.373	1.549
T-103	.	0.969	---	---	---
T-104	0.474	0.700	0.101	0.172	1.228
T-105	.	0.612	---	---	---
T-106	.	0.953	---	---	---
T-107	0.722	0.716	0.086	0.201	1.231
T-108	.	0.634	---	---	---
T-109	.	0.374	---	---	---
T-110	0.75	0.346	0.149	-0.237	0.928
T-111	0.094	0.249	0.099	-0.277	0.776
T-112	.	0.252	---	---	---
T-201	.	0.131	0.146	-0.447	0.708
T-202	.	0.131	0.146	-0.447	0.708
T-203	.	0.131	0.146	-0.447	0.708
T-204	.	0.131	0.146	-0.447	0.708
TX-101	.	0.510	---	---	---
TX-102	.	0.374	---	---	---
TX-103	.	0.374	---	---	---
TX-104	.	0.495	---	---	---
TX-105	.	0.374	---	---	---
TX-106	.	0.380	---	---	---
TX-107	.	0.374	---	---	---
TX-108	.	0.376	---	---	---
TX-109	.	0.700	0.101	0.172	1.228
TX-110	.	0.405	---	---	---
TX-111	.	0.420	---	---	---
TX-112	.	0.374	---	---	---
TX-113	.	0.374	---	---	---

Table C-6. Aluminum Leach Factor Predictions and Uncertainties

Tank	TLF	Pred TLF	Std Err	Lower	Upper	Tank	TLF	Pred TLF	Std Err	Lower	Upper
TX-114	.	0.377	---	---	---	AN-101	.	0.000	---	---	---
TX-115	.	0.375	---	---	---	AN-102	.	0.000	0.215	-0.676	0.676
TX-116	.	0.460	---	---	---	AN-103	.	0.000	0.215	-0.676	0.676
TX-117	.	0.379	---	---	---	AN-104	0	0.000	0.215	-0.676	0.676
TX-118	.	0.468	---	---	---	AN-105	.	0.000	0.215	-0.676	0.676
TY-101	.	0.373	---	---	---	AN-106	.	0.000	---	---	---
TY-102	.	0.374	---	---	---	AN-107	.	0.000	0.215	-0.676	0.676
TY-103	.	0.535	---	---	---	AP-101	.	0.000	---	---	---
TY-104	0.48	0.480	0.215	-0.196	1.156	AP-102	.	0.517	---	---	---
TY-105	.	0.739	0.184	0.109	1.369	AP-103	.	0.000	---	---	---
TY-106	.	0.840	0.277	0.059	1.621	AP-104	.	0.000	---	---	---
U-101	.	0.517	---	---	---	AP-105	.	0.000	0.215	-0.676	0.676
U-102	.	0.446	---	---	---	AP-106	.	0.000	---	---	---
U-103	.	0.409	---	---	---	AP-107	.	0.000	---	---	---
U-104	.	0.531	---	---	---	AP-108	.	0.000	---	---	---
U-105	.	0.935	---	---	---	AW-101	.	0.000	0.215	-0.676	0.676
U-106	.	0.374	---	---	---	AW-102	.	0.961	---	---	---
U-107	.	0.966	---	---	---	AW-103	.	0.065	---	---	---
U-108	.	0.856	---	---	---	AW-104	.	0.458	---	---	---
U-109	.	0.945	---	---	---	AW-105	.	0.223	---	---	---
U-110	0.648	0.433	---	---	---	AW-106	.	0.000	0.215	-0.676	0.676
U-111	.	0.495	---	---	---	AY-101	.	0.517	---	---	---
U-112	.	0.874	---	---	---	AY-102	.	0.000	---	---	---
U-201	.	1.000	---	---	---	AZ-101	.	0.588	0.214	-0.086	1.263
U-202	.	1.000	---	---	---	AZ-102	0.628	0.588	0.214	-0.086	1.263
U-203	.	1.000	---	---	---	SY-101	.	0.746	0.215	0.070	1.422
U-204	.	1.000	---	---	---	SY-102	.	0.517	---	---	---
---						SY-103	0.746	0.746	0.215	0.070	1.422

Note that some of the standard errors are quite high. These are typically attributable to tanks with multiple waste types, only one sample from which to glean information, or a combination of both.

C3.0 COMPARISON BETWEEN STATISTICAL SOFTWARE RESULTS

Statistical software (JMP™, The Statistical Discovery Software, English Edition, Professional Edition, Version 5) was used to estimate waste type wash-leach factors by linear regression and to estimate uncertainties in this appendix. JMP™ results were verified by replicating the calculation using S-Plus™, Version 6.0 statistical software. Both analyses used the data shown in Tables C-1 and C-2 and a comparison of results are shown in Table C-7. Results for the two statistical software applications were identical.

Table C-7. Comparison between JMP™ and S-Plus Results.

Waste Type	JMP™ Result	S-Plus™ Result
BL	0.021	0.021
BSltCk	0.029	0.029
BYSltCk	0.018	0.018
CWP	0.018	0.018
CWR	0.934	0.934
CWZr	0.973	0.973
DE	-0.112	-0.112
HS	3.468	3.468
MW	0.069	0.069
OWW3	-0.054	-0.054
P2.P3	0.621	0.621
PFeCN	0.076	0.076
PL2	0.103	0.103
Portland Cement	-0.174	-0.174
R-B	-0.035	-0.035
R-NB	-0.309	-0.309
RSltCk-B	0.000	0.000
RSltCk-NB	-0.423	-0.423
S1SltCk-B	0.023	0.023
S1SltCk-NB	1.910	1.910
S2SltSlr-SST	0.000	0.000
S2SltSlr-DST	0.000	0.000
SRR	0.058	0.058
T1SltCk	0.754	0.754
T2SltCk	-0.098	-0.098
TBP	1.298	1.298
TFeCN	0.576	0.576
TH1	0.751	0.751
TH2	1.189	1.189
Z	0.090	0.090
NA	-0.072	-0.072

™ JMP is a business unit of SAS (Statistical Analysis Software), and is a registered trademark of the SAS Institute Inc., SAS Campus Drive, Cary, NC 27513.

™ S-Plus is a registered trademark of Insightful, 1700 Westlake Avenue North, Suite 500, Seattle, WA 98109.

C4.0 SUMMARY AND CONCLUSIONS

Several assumptions went into this analysis. In particular, they include

- The mass weighted proportions were treated as measured data
- The statistical model used reflects physical reality
- The errors in the model are normally distributed and the estimates associated with the model unbiased.

The authors want to remind the reader of such assumptions when the estimates are considered.

Tables C-5 and C-6 show that more information is available for the wash factors as opposed to the leach factors. This is expected, as there was twice as much data for the wash as there was for the leach. A closer look at Table C-6 shows that the TX tanks have no information (no data), and that analyses are necessary to understand the waste types associated with those tanks (R-NB and T2SltCk, mostly—both of these waste types had no data). The U tanks had only 1 data point, and the double-shell tanks had only 3. These are glaring areas where little information is available. The wash factor data appear to have a better distribution across all the types of tanks and the estimates for the wash factors have less uncertainty then do the leach factors.

APPENDIX D

INDEPENDENT REVIEW

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Figure 3. Calculation Review Checklist.

Calculation Reviewed: Aluminum Water Wash and Caustic Leach Factors (RPP-11079 Draft)

Scope of Review: Input Data, Calculation Methodology and Wash/Leach Factor Results
(e.g., document section or portion of calculation)

Engineer/Analyst: David E. Place David E. Place Date: 7/9/03

Organizational Mgr: Nick Kirch NWKirch Date: 7/9/03

This document consists of 96 pages and the following attachments (if applicable):

Yes	No	NA*		
[X]	[ ]	[ ]	1.	Analytical and technical approaches and results are reasonable and appropriate.
[X]	[ ]	[ ]	2.	Necessary assumptions are reasonable, explicitly stated, and supported.
[X]	[ ]	[ ]	3.	Ensure calculations that use software include a paper printout, microfiche, CD ROM, or other electronic file of the input data and identification to the computer codes and versions used, or provide alternate documentation to uniquely and clearly identify the exact coding and execution process.
[X]	[ ]	[ ]	4.	Input data were checked for consistency with original source information.
[X]	[ ]	[ ]	5.	For both qualitative and quantitative data, uncertainties are recognized and discussed.
[ ]	[ ]	[X]	6.	Mathematical derivations were checked including dimensional consistency of results.
[X]	[ ]	[ ]	7.	Calculations are sufficiently detailed such that a technically qualified person can understand the analysis without requiring outside information.
[X]	[ ]	[ ]	8.	Software verification and validation are addressed adequately.
[ ]	[ ]	[X]	9.	Limits/criteria/guidelines applied to the analysis results are appropriate and referenced. Limits/criteria/guidelines were checked against references.
[X]	[ ]	[ ]	10.	Conclusions are consistent with analytical results and applicable limits.
[X]	[ ]	[ ]	11.	Results and conclusions address all points in the purpose.
[X]	[ ]	[ ]	12.	Referenced documents are retrievable or otherwise available.
[X]	[ ]	[ ]	13.	The version or revision of each reference is cited.
[X]	[ ]	[ ]	14.	The document was prepared in accordance with Attachment A, "Calculation Format and Preparation Instructions."
[X]	[ ]	[ ]	15.	All checker comments have been dispositioned and the design media matches the calculations.

David E. Place David E. Place 7/9/03
Checker (Printed Name and Signature) Date

- If No or NA is chosen, an explanation must be provided on or attached to this form.
-

NA Exceptions: Item 6 The wash and leach factors are dimensionless. Item 9 There are no limits, criteria or guidelines applicable to the wash and leach factor analysis.

Analytical Calculations.

Subject: Aluminum Water Wash and Caustic Leach Factors (RPP-11079 Rev. 0 Draft)

Objective/Purpose: Derive a method for estimating aluminum water wash and caustic leach factors for Hanford tank wastes based on Hanford Defined Waste (HDW) model waste types. Verify the empirical correlations by comparing the predictions to the measured values used in the derivation.

Open Items: (required only if there are open items)

None

Methods of Analysis:

An empirical model was developed from water solubility data contained in the TCD and from laboratory solubility testing for both sludge and saltcakes. Water wash and caustic leach factors for the predominant HDW model waste types were developed using multiple regression techniques. Waste subtypes were added to account for differences in temperature history. The wash and leach factors were estimated for each waste type assuming that the wash and leach behavior were consistent for all locations of that waste type and that the factors for a composite tank vary in direct proportion to the mass of the aluminum of each waste type. Based on the derived wash and leach factors, the overall factors were estimated for each of the 177 tanks based on the BBI waste types.

The predicted wash and leach factors were plotted against the actual existing data. Uncertainties for each of these predictions were developed from statistical evaluation.

Input Data: RPP-11079 Draft Rev. 0, Spreadsheets, including: Al W&L Pi TWF TLF.xls (output of multiple regression analysis), Al_Wash_and_Leach_Factor_Calculations.xls, Al_Wash_Data.xls and Cr_Al_Leach_Kinetics_1.xls.

Results:

Verification was limited to the input data, methodology and calculations directly used in the derivation of the wash and leach factors and the use of the derived factors in predicting the composite factors for 177 tanks.

1. The mass of aluminum for each waste type was electronically downloaded form TWINS (Best Basis Calculation Detail Report, download date 3/27/03).
2. All wash factors derived from the Tank Characterization Database were recalculated using results from fusion digest sample preparations (when available) after spot checking revealed that acid digest sample preparations were often failing to adequately dissolve the aluminum. All of the Table 4-3 and Table 4-4 wash factors calculated from TCD data were checked against the recalculations and no errors were found.
3. A spot check of the source wash factors data from the sludge/saltcake tests (seven tanks) revealed no problems.
4. A spot check of the 8-hour leach factor estimates (seven tanks) revealed no errors.
5. The wash and leach factor data provided in Tables 4-3, 4-4 and 4-6 of the draft document was compared to the input data for the multiple regression analysis. All previously identified discrepancies had been corrected.
6. The results from the multiple regression analysis were compared spreadsheet predictions using similar assumptions. The results from the two methods are expected to be somewhat different since the spreadsheet uses a reduced data set as input and employs aluminum mass weighting when predicting wash and leach factors for sludge or saltcake for which data are unavailable (as opposed to arithmetic averaging).

- The multiple regression and spreadsheet wash factor predictions are generally in good agreement with a correlation coefficient of 0.88. Four of the 25 waste types compared (S1 Saltcake boiling and non boiling, BY Saltcake and Redox sludge non boiling) account for most of the difference between the two methods. The correlation coefficient increases to 0.99 if these four data points are excluded from the comparison.
- The multiple regression and spreadsheet leach factor predictions are only in fair agreement with a correlation coefficient of 0.42. Two of the 14 waste types compared (S1 Saltcake boiling and BY Saltcake) account for most of the difference between the two methods. The correlation coefficient increases to 0.92 if these two data points are removed from the comparison
- The multiple regression analysis utilizes more of the limited tank waste data available and would be expected to be better prediction tool. However, the comparison does indicate that the wash and leach factors for S1 Saltcake, Redox sludge (non boiling) and BY Saltcake may be less reliable.

Conclusions:
Water wash and caustic leach factors are dependent on the initial waste concentration, volume/composition/temperature of the leachate, valences of the metal constituents and the chemical species (compounds) present. Justification of such factors on a strict technical basis is difficult. However, the need to predict the data for all tank farm wastes from limited data available makes the use of this simplistic method a necessity. For aluminum, the use of more technically defensible methods (such solubility limits or thermodynamic modeling) would not improve the situation since aluminum can exist as in number of chemical forms and the concentration of the hydroxide ion and the temperature history are largely unknown.

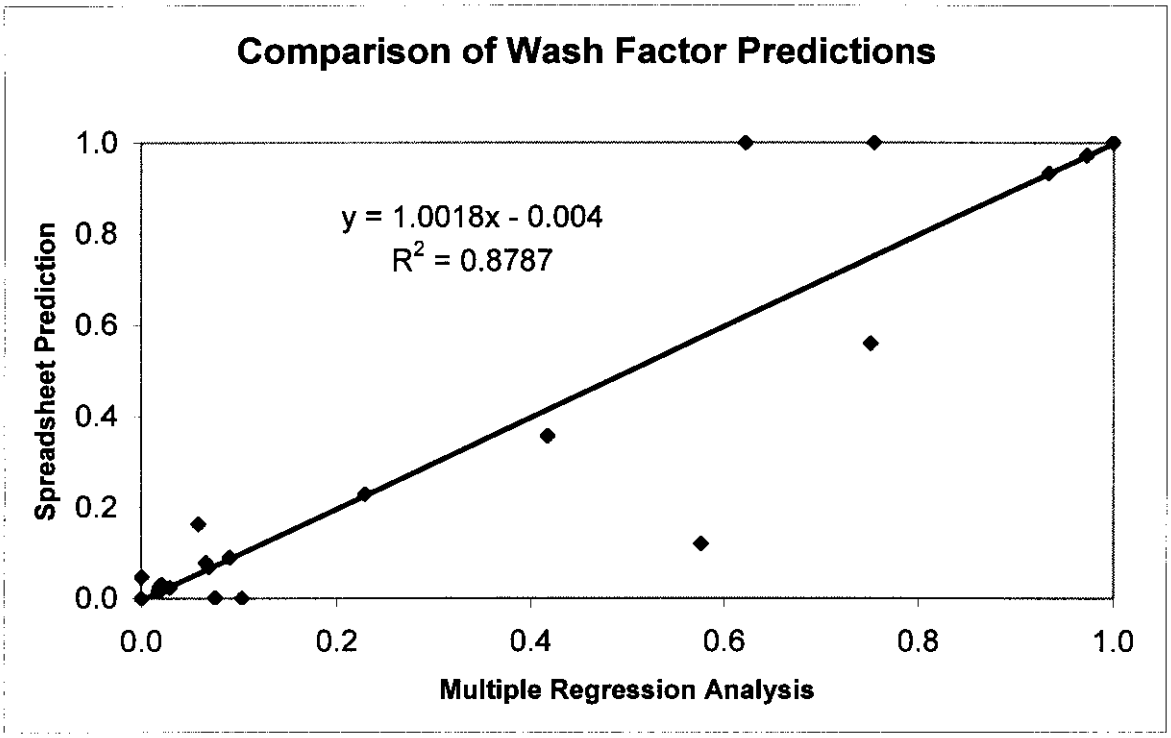
The current Al wash and leach factor model should represent an improvement from the previous Sort on Radioactive Waste Type (SORWT) and cluster analyses predictions because more and better tank waste data are available (both solubility and tank inventory data) and the leach factor was adjusted to the eight hour processing time available at the Waste Treatment Plant (WTP).

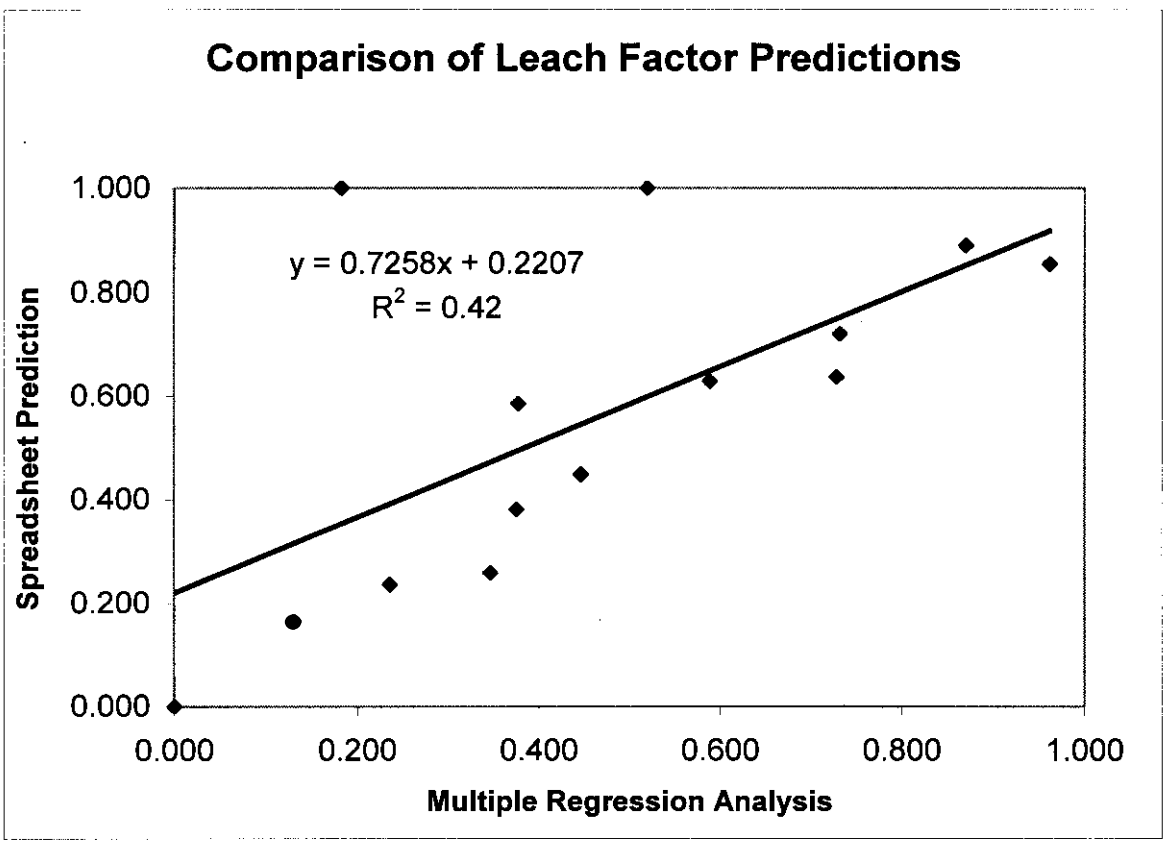
Wash Factor Comparison

Waste Type	Multiple Regression	Spreadsheet
BSltCk	0.000	0.047
DE	0.000	0.000
RSltCk-B	0.000	0.000
224	0.018	0.018
2C	0.018	0.025
TFeCN	0.020	0.019
1C	0.021	0.030
P2/P3	0.023	0.025
1CFeCN	0.029	0.023
R-B	0.058	0.163
TBP	0.066	0.079
BL	0.069	0.069
CWP	0.076	0.001
S2SltSlr-DST	0.090	0.090
CWR	0.103	0.000
Z	0.229	0.229
T2SltCk	0.417	0.357
S1SltCk-B	0.576	0.120
BYSltCk	0.621	0.999
S1SltCk-NB	0.751	0.560
R-NB	0.754	1.000
A1SltCk	0.934	0.933
A2SltSlr	0.973	0.973
RSltCk-NB	1.000	1.000
S2SltSlr-SST	1.000	1.000

Leach Factor Comparison

Waste Type	Multiple Regression	Spreadsheet
A2SltSlr	0.000	0.000
224	0.131	0.165
S1SltCk-B	0.182	1.000
R-B	0.236	0.236
2C	0.346	0.259
1CFeCN	0.375	0.381
RSltCk-B	0.377	0.585
TFeCN	0.446	0.448
BYSltCk	0.520	1.000
P2/P3	0.588	0.628
1C	0.728	0.636
TBP	0.732	0.720
DE	0.870	0.890
CWP	0.962	0.855


Comparison of Wash Factor Predictions
y = 1.0018x - 0.004
R2 = 0.8787
Spreadsheet Prediction
Multiple Regression Analysis
0.0
0.2
0.4
0.6
0.8
1.0


Comparison of Leach Factor Predictions
y = 0.7258x + 0.2207
R2 = 0.42
Spreadsheet Prediction
Multiple Regression Analysis
0.000
0.200
0.400
0.600
0.800
1.000

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