Nuclear Safety of Extended Sludge Processing on Tank 42 and 51 Sludge (DWPF Sludge Feed Batch One)

by

J. S. Clemons

Westinghouse Savannah River Company
Savannah River Site
Aiken, South Carolina 29808

MASTER

DOE Contract No. DE-AC09-89SR18035

DISCLAIMER

HIGH LEVEL WASTE ENGINEERING
HIGH LEVEL ENGINEERING SUPPORT

WSRC-TR-93-115

REVISION: 0

KEYWORDS:
Criticality Safety
Sludge
ESP
Uranium-235
Plutonium-239

RETENTION:
PERMANENT

UNCLASSIFIED

NUCLEAR SAFETY OF EXTENDED SLUDGE PROCESSING ON TANK 42 AND 51 SLUDGE (DWPF SLUDGE FEED BATCH ONE). (U)

CLASSIFICATION: U
Paul D. d'Entremont
Authorized Derivative Classifier

BY

J. S. CLEMMONS

ISSUED: February 26, 1993

J. S. Clemmons, Author — Date: 2/26/93

W. S. Cavin, Technical Reviewer — Date: 2/26/93

N. E. Bibler, Technical Reviewer — Date: 2/21/93

M. C. Chandler, Manager, HLLW Technologies Studies — Date: 3/1/93

J. E. Marra, Manager, HLW Engineering Support — Date: 3/1/93

T. M. Monahon, Manager, HLWE (Approved) — J. G. Dickert for T. M. Monahon — Date: 3/1/93

INTRODUCTION

The sludge in tanks 42 and 51 is to be washed with inhibited water to remove soluble salts and combined in tank 51 in preparation for feed to DWPF. Since these tanks contain uranium and plutonium, the process of washing must be evaluated to ensure subcriticality is maintained. When the sludge is washed, inhibited water is added, the tank contents are slurried and allowed to settle The sludge wash water is then decanted to the evaporator feed tank where it is fed to the evaporator to reduce the volume. The resulting evaporator concentrate is sent to a salt tank where it cools and forms crystallized salt cake. This salt cake will later be dissolved, processed in ITP and sent to Z-Area. This report evaluates the supernate and sludge during washing, the impact on the evaporator during concentration of decanted wash water, and the salt tank where the concentrated supernate is deposited. The conclusions generated in this report are specific to the sludge currently contained in tanks 42 and 51.

SUMMARY

The contents of tank 42 and 51 may be washed with inhibited water and combined in tank 51 without the risk of criticality. The dilute concentration of fissile material in the sludge combined with an excess of neutron absorbers before, during and after washing make criticality in tanks 42 and 51 incredible. Prior sludge washing experience indicates that there is insufficient fissile material dissolved in the wash water to impact the safe operation of the evaporator system. The fissile material concentration in the washes will be monitored for continued confirmation through sampling during the Extended Sludge Processing (ESP) operation.

DISCUSSION

Waste Tank Sludge

There are three characteristics of SRS waste tank sludge that make criticality incredible [5], insufficient areal density of fissile material, insufficient concentration of fissile material and an excess of neutron absorbers present in the sludge. To evaluate the nuclear safety of sludge washing, the effect of washing on areal density, concentration and neutron absorbers must be determined. Comparison of fissile material areal density and concentration to safe values requires an estimate of the fissile material in a tank. Three estimates of the fissile material content for both tanks 42 and 51 have been performed. The results of these estimates are listed in tables 1 and 2 respectively.

Table 1. Tank 42 Estimated Fissile Material Content.

Parameter	ALPHA	Sample Data[10]	ALPHA II [1]
Total Uranium (kgs)	5063*	8502	3364
U-235 (kgs)	38 8*	47.9	23.5
U-235/Total U (wt.%)	0 77%	0 563%	0 7%
Plutonium-239 (kgs)	24 2	23.7	24.8
Sludge Volume (kgals)	260	260	260
Tank Surface Area (ft²)	5646	5646	5646
U-235 Areal Density (g/ft²)	6 9	8.6	4.2
Pu-239 Areal Density (g/ft²)	4.3	4.4	4.4
U-235 Concentration (g/l)	0.039	0.049	0.024
Pu-239 Concentration (g/l)	0 025	0.025	0.025

* ALPHA does not account for uranium transferred out during tank 42 ESP demo

Table 2. Tank 51 Estimated Fissile Material Content.

Parameter	ALPHA	Sample Data [2,9]	ALPHA II[4]
Total Uranium (kgs)	7687	9200	4978
U-235 (kgs)	26.3	48	15.4
U-235/Total U (wt.%)	0.34%	0.52%	0.31%
Pu-239 (kgs)	23.6	54	13.6
Sludge Volume (kgal)	263	263	263
Tank Surface Area (ft²)	5646	5646	5646
U-235 Areal Density (g/ft²)	4 7	8.6	2.7
Pu-239 Areal Density (g/ft²)	4 2	9.5	2.4
U-235 Concentration (g/l)	0 026	0.048	0.016
Pu-239 Concentration (g/l)	0 024	0.054	0.014

The ALPHA estimates are based on accountability data and are known to have questionable accuracy. The sample estimates are determined by taking the concentrations found in the sample volume and multiplying by the volume of sludge in the waste tank. The ALPHA II estimates are based on a recreation of canyon waste discharges coupled with a recreation of the waste tank receipt and transfer history. The Pu-239 and U-235 mass estimates are not equal, however all of the estimates show that tanks 42 and 51 contain U with an U-235 content at or below that of natural U and that the concentration and areal density of U-235 and Pu-239 are extremely low. For comparison to safe values, the estimates determined from sample analysis will be used. This is conservative since the sample data indicates the largest amount of U and Pu. Based on the amount of previous slurrying associated with transfer and washing, the contents of tank 42 and 51 should be well mixed. Additional washing and slurrying of the tank contents will provide further mixing.

Based on the sample estimates from table 1 and 2, when the sludge in tank 42 is combined with that in tank 51, the equivalent Pu-239 (conservatively assuming all U-235 is Pu-239) areal density and concentration will be 31.1 g/ft^2 and 0.089 g/l respectively. This is significantly less than the single parameter sub-critical areal density (231 g/ft^2) and concentration (7.3 g/l) limits [3] given for Pu-239 in uniform aqueous solutions. The sub-critical limits of reference 3 were determined for a solution of $Pu(NO_3)_4$ but are conservative when applied to waste tank sludge because N and O are replaced in part with stronger neutron absorbers such as the diluents listed in table 3. Washing the sludge may reduce the sludge volume slightly. This would increase the fissile material concentration but would not affect the areal density. To increase the equivalent Pu-239 concentration from 0.089 g/l to 7.3 g/l, the sludge volume would need to be reduced to 1.2 % of its current volume, which is essentially impossible due to the low concentrations of sludge components removed during washing. Tank 42 and 51 contents will remain safe once combined after washing based on the low fissile material areal density and concentration.

Table 3. Weight Ratios of Diluents to Fissile Material For Tanks 42 and 51.

	TANK 51[9]		TANK 42[10,13]	
Diluent	Wt. Ratio to Pu-239	Wt. Ratio to U-235	Wt. Ratio to Pu-239	Wt. Ratio to U-235
Fe	1410	1560	2860	1410
Al	412	455	1050	517
U-238	174	192	357	176
Mn	146	161	476	235
Mg	71	78	166	82
Ni	17	18	46	23
Cr	9	10	18	9
Hg	1	1	127	63

Reference 5 documents the abundance of neutron absorbing materials that are present in waste tank sludge, specifically Fe and Mn. In order to take credit for the neutron absorbing properties of Mn and Fe, they must remain in the sludge during and after ESP processing. Sludge samples from tanks 42 and 51 confirm an abundance of Mn and Fe even after being washed several times. The abundance of Fe and Mn in the sample results confirms that they remain primarily insoluble and thus remain in the sludge. Table 4 gives the amount of Fe and Mn removed from tank 42 during the 1982/83 ESP demonstration. The amount of Mn and Fe that was decanted during the ESP demonstration was insignificant when compared to the amount that remained insoluble [6]. In some instances the Mn and Fe concentrations in the supernate were below the detection limit of the analytical equipment. The solubility of Mn and Fe in the alkaline waste tank supernate has historically been low. This is consistent with the literature [14,15,16] on Mn and Fe compounds in alkaline solutions.

Table 4. Materials Transferred Out of Tank 42 During ESP Demonstration. [6]

Process Step	Vol. (kgal)	U kgs	Pu-239 grams	Fe kgs	Mn kgs
Slurry/Transfer	642	2.9	6.4	---	0.3
Al Dissolution	424	20.4	4.7	2.4	3.7
First Wash	937	3.5	0.35	---	---
Second Wash	942	0.7	0.29	3.9	1.4
Third Wash	527	0.6	0.12	2.4	---
Total	**3,472**	**28**	**12**	**8.7***	**5.4***

*Partial Total
--- Below detection limit

Table 5 compares the weight ratios of Fe and Mn to Pu-239 and U-235 found in tank 42 and 51 sludge samples to calculated safe weight ratios [11,12]. A documented fissile equivalency between U-235 and Pu-239 in waste tank sludge has not yet been published; however, due to the excessive margin of safety a simplistic conservative equivalency model can be used. Safe weight ratios of Fe and Mn to Pu-239 are greater than the safe weight ratios of Fe and Mn to U-235 [11,12]. It is reasonable to assume that when U-235 and Pu-239 exist together, the safe weight ratios of Fe and Mn to this combination will be no greater than for an equal proportion of Pu-239. Employing this approach shows the existing Fe and Mn to equivalent Pu-239 (U-235 + Pu-239) weight ratio is approximately 7 times the infinite safe value. Applying only the Fe and Mn safe weight ratios is conservative since no credit is taken for several other diluents that are significant neutron absorbers such as those in table 3.

Table 5. Comparison of Fe and Mn to U-235 and Pu-239 Weight Ratios vs. Calculated Safe Weight Ratios. [11,12]

Absorber to Fissile	**Tank 42** [10,13] **Wt. Ratio**	**Tank 51** [9] **Wt. Ratio**	**Safe Wt.** [11,12] **Ratios**
Mn:U-235	235:1	161:1	30:1
Fe:U-235	1410:1	1560:1	77:1
Fe:Mn:U-235	1410:235:1	1560:161:1	60:6:1
Mn:Pu-239	476:1	146:1	32:1
Fe:Pu-239	2860:1	1410:1	160:1
Fe:Mn:Pu-239	2860:476 1	1410:146:1	110:11:1
Mn:Eq. Pu-239*	157:1	77:1	32:1
Fe:Eq. Pu-239*	946:1	742:1	160:1
Fe:Mn:Eq. Pu-239*	946:157 1	742:77:1	110:11:1

*All U-235 assumed to be Pu-239 for comparison to safe Pu-239 weight ratios.

Sludge Wash Water

Criticality in waste tank supernate is incredible due to the very dilute concentrations of fissile material. Uranium and plutonium solubility [17] in the alkaline supernate of the waste tanks is several orders of magnitude lower than that required for criticality The maximum Pu-239 and U concentration of the water washes during the 1982 ESP demonstration were 0.0001 mg/l and 1 0 mg/l respectively [6] To assess the safety margin, compare to subcritical concentration limits for Pu-239 and U-235 of 7.3 g/l and 11.6 g/l [3] respectively. The wash water used in ESP is inhibited with NaOH for corrosion prevention, thus the chemistry throughout ESP operations remains alkaline.

Salt Precipitate From Evaporated Wash Water

As stated earlier, U and Pu are only slightly soluble in alkaline waste tank supernate [17]. Thus the amount of Pu and U in supernate is a fraction of that found in sludge. This is true of sludge wash water as well. The volume reduction associated with evaporation concentrates the U and Pu along with all other dissolved solids in the wash water. If the volume reduction concentrates any of these solids past their solubility limit, they crystallize and precipitate from solution. If U and/or Pu precipitate and somehow selectively accumulate, the potential would exist for a criticality. If this precipitation occurs in a waste tank, the fissile material is distributed and safe. If the precipitation and accumulation occurred in the bottom of the evaporator, it may not be. Please note that the evaporator vessel is an inverted cone and its design incorporates a steam lift to prevent solids accumulation [18], however in this assessment it is not necessary to take credit for this feature.

Tank 42 and tank 51 contain U that is at or less than the U-235 content in natural U[2,10]. When these tanks are washed during sludge processing, any U that is removed by the wash water will remain subcritical regardless of its concentration, geometry or total mass. This is wholly due to the uranium-235 isotope deficiency. The only fissile material of concern in further washing of the sludge is plutonium. Sample data from the tank 42 sludge processing demonstration [6] shows that plutonium remains predominantly in the sludge during aluminum dissolution and sludge washing. Table 4 shows the amount of uranium and Pu-239 that left tank 42 during the 1982 ESP demonstration. These amounts are based on sample data from the demonstration and the amount of supernate transferred. Precipitating solutions with Pu concentrations similar to those of the ESP demonstration is clearly safe when compared to a safe Pu-239 mass of 450 grams [3].

Due to the complex chemistry of high level liquid waste, it is difficult if not impossible to predict the exact mass of soluble Pu that may be transferred into the evaporator system, though the quantity would always be bounded by solubility. Historical supernate sample data indicates it will be small. The ESP demonstration data also indicates it will be small. The Pu concentrations from sample data and the ESP demonstration data are many times less than solubility would predict due to the fact Pu is not being dissolved and/or the kinetics of dissolution are extremely slow [17].

The ESP supernate will be sampled for Pu to confirm that Pu is not being transferred to the evaporator system in quantities that may impact safe operation. When this sample is pulled, it will be analyzed for U, Mn and Fe as well. Knowing the concentration of these elements in the decanted ESP supernate and the volume of the decant will also allow HLWE Criticality Safety to confirm the safe ratios in the sludge are maintained. The concentration sample results will continue to provide data on Pu and U solubility.

CONCLUSIONS

Sludge samples of tank 42 and 51 show dilute concentrations of fissile material with an abundance of Fe, Mn and other diluents. The fissile material concentration and areal density are less than published single parameter fissile material limits, which are established in the absence of Fe, Mn and the other neutron absorbing diluents. The sample data are consistent with the estimates from accountability and waste history in terms of dilute concentrations of fissile material and U at or below the U-235 content of natural U. Both tanks' contents have been slurried and well mixed. The Fe and Mn to fissile material weight ratios are in tremendous excess of the calculated safe values. If credit were taken for the other neutron absorbing diluents present in the waste, the margin of safety would greatly increase. Mn and Fe remain predominantly in the sludge throughout Al dissolution and sludge washing. The large margin of safety associated with the Fe and Mn to fissile material weight ratios will not be impacted by continued washing of tanks 42 and 51.

Since the U in tanks 42 and 51 is at or below the U-235 content of natural U, any amount of U that is removed from sludge and transferred to the evaporator system will be safe regardless of total mass, geometry or concentration. This is entirely attributable to the U-235 isotope deficiency. Sample results from the ESP demonstration showed that Pu followed dilution throughout Al dissolution and sludge washing. These sample results also found that the Pu concentration in the decants during the ESP demonstration were approximately three orders of magnitude less than that of the U. Transferring tens of grams quantities of Pu-239 contained in hundreds of thousands of gallons of wash water to the evaporator system will not impact safe operation. If the entire wash volume were boiled to dryness, there would be insufficient material for criticality. There is no evidence to indicate that this chemistry will change with continued washing.

ACTIONS

After settling and prior to decant. ESP supernate will be sampled for Pu, U, Fe and Mn. The analysis will determine the concentration of Pu, U, Fe and Mn in the wash water decanted In addition, isotopic analysis will be performed on Pu and U to confirm the sludge sample, accountability and waste history estimates. Using this information along with the volume of the decant, an estimate of the amount of these materials that are removed from the tanks can be performed. The sample results will not be used as a control since there are no controlling limits The sample results will be used by HLWE to confirm that the Mn and Fe to fissile material weight ratios are still in excess of the calculated safe weight ratios and to determine the amount of fissile material transferred to the evaporator system. Confirmation through sampling is the most conclusive method available to demonstrate safe operation and to build upon the technical safety basis.

REFERENCES

[1] WSRC-RP-92-1166, Rev. 1, W. S. Cavin, "Uranium Precipitate Characteristics and Tank 42 Fissile Content"(U), November 18, 1992.

[2] C. J. Coleman, N. E. Bibler, R. A. Dewberry, "Analyses of High Level Radioactive Glasses and Sludges at the Savannah River Site". Proceedings of Waste Management '90, Tuscon, AZ, pp 651-657.

[3] ANSI/ANS-8.1-1983, Nuclear Criticality Safety in Operations With Fissionable Materials Outside Reactors

[4] WER-HLE-921217, Crumm to Clemmons, "Tank 51 Fissile Material Estimation" (U), November 18, 1992.

[5] WER-WME-921007, Revision 1, Clemmons to Chandler, "Nuclear Criticality Safety of Waste Tank Sludge For ESP" (U), August 12, 1992.

[6] WER-HLE-930561, Clemmons to Chandler, "Effect of ESP on Waste Tank Sludge U, Pu, Fe and Mn Content (U)", February 10, 1993.

[7] WSRC-RP-91-78-3B, "Waste Management Monthly Data Record", March 1991 (U)

[8] WSRC-RP-92-78-9B, "Waste Management Monthly Data Record", September 1992. (U)

[9] SRT-CTS-92-242, Cavin to Clem[illegible] "Tank 51 Diluent to Fissile Ratios", 11/18/92.(U)

[10] WSRC-RP-93-262, Bibler, Wyrick, Dewberry and Coleman to Holtzscheiter and Coffey, "Uranium and Plutonium Concentrations and Isotopics in Tank 42 Sludge Slurry" (U), February 25, 1993

[11] WER-WME-921143, Clemmons, Goslen to Chandler, NCSA WM-92-3, "Minimum Safe Ratios of Fe and Mn to U-235 in an Infinite System" (U), September 18, 1992.

[12] WER-HLE-921353, Clemmons, Goslen to Chandler, NCSA WM-92-5, "Minimum Safe Ratios of Fe and Mn to Pu-239 in an Infinite System" (U), November 25, 1992.

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[15] A. Seidell, Solubilities of Inorganic and Metal Organic Compounds, 3rd edition, Van Nostrand, New York, 1940, Volume I, page 1004.

[16] A. Seidell, Solubilities of Inorganic and Metal Organic Compounds, 4th edition, Van Nostrand, New York, 1965, Volume I, page 1038-1039.

[17] WSRC-TR-93-056, "Solubility of Plutonium and Uranium in Alkaline Salt Solutions (U)", February 12, 1993.

[18] WSRC-TR-93-081, "Evaluation of Potential Accumulation of Uranium and/or Plutonium in the HLW Evaporator Systems (U)", February 1,1993

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(Technical Review Package Originator, location)

Technical Review No. SR-HLE-93-557

692765

Indirect Work Request No., Procedure No., or other Proposed Activity No. WSRC-TR-93-115 - Addendum

Title: Potential Inadequacy in the Authorization Basis for Criticality Safety Involving Evaporation of ESP Batch One Wash Water

The attached HLWE Technical Review Package (referenced above) has been prepared in accordance with WM-NS-7012, "Technical Reviews", and contains the following:

Design Input Form
- ☐ Included (For Indirect Work Requests Only)
- ☒ N/A

Screening Process Hazards Review Report (SPHR)
- ☐ Included
- ☒ Not included per Procedure WM-NS-7012
- ☐ Not included per the following:

For operating procedures that will not require a SPHR, specify (below) the Periodic PHR (or other applicable PHR) that affects or is related to the procedure. For procedures that are (or should be) designated "Q", ensure that the PHR and Action item (or recommendation) numbers are listed in the procedure, and include the PHR# and related comments on the Procedure Review Sheet.

Periodic PHR#: 200 - N/A

Unreviewed Safety Question Determination (USQD)
- ☒ Included
- ☐ Not included per Procedure WM-NS-7012
- ☐ Not included per the following:

WM Environmental Compliance Checklist (ECC)
- ☐ Included
- ☒ Not included per Procedure WM-NS-7012
- ☐ Not included per the following:

other comments: TECHNICAL REPORT, WSRC-TR-93-115, provides a supplemental analysis of criticality safety impact of evaporating ESP batch one wash water supplementing Safety Analysis Report DPSTSA-200-10-Sup-18 and Authorization Basis Document, WSRC-TR-93-081.

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PROPOSED ACTIVITY TITLE: Potential Inadequacy in the Authorization Basis for Criticality Safety Involving Evaporation of ESP Batch One Wash Water

A.1 Description of Proposed Activity (or Discovery): (can say "see SPHR" if attached)

Technical Report, WSRC-TR-93-081, and associated USQD SR-HLE-93-341, evaluated the criticality safety aspects of the Tank Farm evaporator systems and concluded the evaporator systems were safe under all expected conditions. ESP wash water was recognized in WSRC-TR-93-081 as having the potential to create a different condition since lower than normal dissolved solids, thus higher *[continued]*

Proposed Activity Reference Documents:

The reference documents are Technical Report WSRC-TR-93-115, Technical Report WSRC-TR-93-081, and DOE Assessment Report 93-04-08-017.

Have all pending "Safety Documents" of the Authorization Basis been considered ? (N/A if no changes pending)? [ ] N/A [ ] No [X] Yes

A.2 Is a change to the Authorization Basis required? References: (1) Technical Standards (DPSTS-241), and (2) OSR (DPW-86-103 Rev 1), (3) SAR (DPSTSA-200-10-Sup-18), (4) Draft OSR (WSRC-RP-92-1044) [X] No [ ] Yes

Reasons / References:

Technical Report WSRC-TR-93-115 supports the conclusion in the SAR, DPSTSA-200-10-Sup-18, and Technical Report WSRC-TR-93-081, ie. no credible mechanism identified to selectively concentrate and accumulate a critical mass in the SRS HLW evaporators. Technical Report WSRC-TR-93-115 specificaly evaluates the evaporation of ESP wash water for DWPF sludge batch one (including current wash water/supernate) and concluded there is no criticality concern. Sludge batch one is currently in tanks 51 and 42.

If the answer to A.2 is "Yes", Proceed to Part II of this form to complete the USQ Safety Evaluation (A.4).

A.3 Screening Questions

Does the Proposed Activity Involve a: [X] No [ ] Yes

(1) Change to the facility as described in the Authorization Basis? Reasons/References (list section #s reviewed):

This USQD screening provides supplemental information to support criticality safety of ESP processing of DWPF sludge feed batch one wash water from tanks 42 and 51 in response to the DOE Liquid Waste Division Assessment Report 93-04-08-017. The proposed activity addressed by this USQD does not involve a change to the facility.

(2) Change to procedures or methods (other than minor changes), as described in the Authorization Basis? Reasons/References (list section #s reviewed): [X] No [ ] Yes

This USQD screening provides supplemental information to support criticality safety of ESP processing of DWPF sludge feed batch one wash water from tanks 42 and 51 in response to the DOE Liquid Waste Division Assessment Report 93-04-08-017. The proposed activity addressed by this USQD does not involve changes to procedures or methods.

(3) Test or experiment not described in the Authorization Basis? Reasons/References: [X] No [ ] Yes

This USQD screening provides supplemental information to support criticality safety of ESP processing of DWPF sludge feed batch one wash water from tanks 42 and 51. The proposed activity addressed by this USQD does not involve a test or experiment.

(4) Analytical errors, omissions, or inadequacies in the Authorization Basis? Reasons/References: [X] No [ ] Yes

SAR section 5.4.1 discusses the potential for criticality in waste tanks as well as evaporators. These discussions include fissile concentrations in sludge, possibility of transfer errors from Canyon facilities, as well as the possibility of abnormally high fissile content waste being transferred from the Canyon facility into the evaporator feed tank and through an evaporator. *[continued]*

If any question in A.2 or A.3 is answered as "Yes", procede to Part II of this Form to complete the USQ Evaluation safety evaluation (A.4).

If a Authorization Basis change is required, the USQD Originator initiates the process.

Is a USQ Evaluation [A.4.] required? [X] No [ ] Yes

NOTE: Use additional sheets throughout this form as necessary.

James S. Clemmons / 703-H — J S Clemmons / 3/19/93
USQD Originator/Location (print) — Signature/Date

Do you agree with the USQD Originator's USQ Screening? [ ] No [X] Yes

If "No", state reason(s)/ references and return to USQD Originator:

Return to USQD Originator for: [ ] USQ Evaluation [ ] Implementation of PA

Brenda L Lewis, 703-H — Brenda L Lewis 3/19/93
Qualified Reviewer/Location (print) — Signature/Date

Brenda L Lewis, 703-H — Brenda L Lewis 3/19/93
(b) Level 4 Manager/Location (print) — Signature/Date

[NOTE: (a) Parts II and III of this form are not required if USQDO and QR agree that USQ Evaluation is not needed.
(b) L4 Manager signs only at discretion of QR. QR should N/A and initial if not needed.]

PART I USQ Screening

A.1 continued

... volume reduction factors would be present in this stream. DOE LWD Assessment Report 93-04-08-017 also identified that additional evaluation of the ESP wash water was needed before processing this stream.

Technical report WSRC-TR-93-115 addresses the criticality safety of washing the DWPF sludge feed batch one currently contained in tanks 42 and 51. The report shows that sending wash water with uranium and plutonium concentrations similar to those observed in the 1982/83 ESP demonstration is safe and expected. Criticality safety of ESP washing on batch one is concluded based on the uranium-235 isotope deficiency of the uranium inventory and due to the extremely low plutonium concentrations that were characteristic of the ESP demonstration decants. U and Pu analysis of tank 51 supernate confirms this safety basis.

Aluminum dissolution is the only part of ESP known to solubilize a significant mass of fissionable material, uranium. As stated earlier, the uranium inventory in tanks 42 and 51 is depleted in the U-235 isotope and thus not a criticality issue. In addition, aluminum dissolution will not be performed again on the first batch of DWPF sludge feed. Thus this USQD addresses washing the first batch of DWPF sludge feed currently contained in tanks 42 and 51 relative to criticality safety, including evaporation of current and future generated wash water.

A.3(4) continued

Evaporation of ESP wash water is not currently considered adequately addressed in the SAR or Authorization Basis document WSRC-TR-93-081. Evaporation of wash water from DWPF sludge feed batch one has been evaluated in WSRC-TR-93-115. The report concludes there is no criticality concern during processing of batch one and evaporation of the wash water.

After settling and prior to decant, ESP supernate will be sampled. The analyses will include determining the concentration of Pu, U, Fe and Mn. In addition isotopic analyses will be performed on U and Pu to confirm the sludge sample, accountability and waste history estimates. The sample results will be used by HLWE to confirm that the Mn and Fe to fissile material weight ratios are still in excess of the calculated safe weight ratios and to determine the amount of fissile material transferred to the evaporator system. Pu and U sample results for the supernate currently in tank 51 has been evaluated and confirms no criticality safety issue for evaporation of this material. Sampling ESP supernate prior to future transfers is outlined in procedure 241-H-2007.