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 17. SIGNATURE/DISTRIBUTION
 (See Approval Designator for required signatures)

(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN
		Design Authority				3		R.B. Baker			H0-40
		Design Agent				3		B.J. Makenes			H0-40
1	1	Cog. Eng. A.L. Pitner	<i>R.B. Baker</i>	8/12/98	H0-40	3		K.L. Pearce			H7-20
1	1	Cog. Mgr. D.W. Bergmann	<i>D.W. Bergmann</i>	8/12/98	H0-40	3		K.H. Bergsman			X3-85
		QA				3		D.J. Trimble			H0-40
		Safety				3		L.D. Bruggeman			H0-40
		Env.									

18. A. L. Pitner <i>R.B. Baker for</i> 8/10/98 Signature of EDT Originator		19. NA Authorized Representative Date for Receiving Organization		20. <i>D.W. Bergmann</i> 8/14/98 Design Authority/ Cognizant Manager		21. DOE APPROVAL (if required) Ctrl. No. ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments	
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K EAST BASIN SLUDGE VOLUME ESTIMATES FOR INTEGRATED WATER TREATMENT SYSTEM

A.L. Pitner

Duke Engineering & Services Hanford, Inc., Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-96RL13200

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Abstract: Estimates were made of the volume of sludge expected 1) from Integrated Process Strategy (IPS) processing fuel elements and 2) in the fuel storage canisters in K East Basin. These were based on visual observations of fuel element condition in the basin and laboratory measurements of canister sludge density. The estimates, made in early 1997, are reviewed and the basic assumptions used discussed.

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Christine Hellingham 8-12-98
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K EAST BASIN SLUDGE VOLUME ESTIMATES FOR
INTEGRATED WATER TREATMENT SYSTEM

January 1997

Originator:

A. L. Pitner

Peer Review:

R. B. Baker

D. J. Trimble

Purpose

An estimate was made to project the volume of sludge expected from Integrated Process Strategy (IPS) processing of the fuel and in the fuel storage canisters in K East Basin to support the Integrated Water Treatment System (ITWS). The estimates are based on visual observations of fuel condition and laboratory measurements of canister sludge density. A nominal "Working Estimate" as well as an upper level "Working Bound" were developed.

Summary of Results and Conclusions

The Working Estimate of the sludge volume for ITWS design basis is 4300 liter, and the Working Bound is 10,600 liter.

Assumptions

The following assumptions apply in the derivation of these estimates.

- There are approximately 1,100 MTU of fuel contained in about 50,000 fuel assemblies in K East Basin.
- Most of the "bad" fuel that will be lost during cleaning comes from the outer elements, and these outer elements have a volume of about 1 liter each. This is based on visual observations, Reference 3.
- The fraction of fuel assemblies that are in the "Defected" category is 38% (Reference 3). For the "Working Estimate," an average of 2 cm³ (0.002 liter) of exposed reacted fuel would likely be displaced from assemblies in this category during cleaning and become sludge. For the "Working Bound," the corresponding value is 5 cm³ (0.005 liter). It is assumed that these volumes would double as the material is granulated during cleaning operations.
- The fraction of fuel in the "Bad" category is 4% (Reference 3). Based on visual observations of fuel and sludge loss during the recent "lift and look" examinations in the K East Basin, it is projected that 10% of the outer element fuel volume would be lost during cleaning as a "Working Estimate." For the "Working Bound," the corresponding value is estimated to be 25%. Based on the metallic fuel density (i.e., ~19 g/cm³) and measured sludge densities from initial samples of K East canister sludge (i.e., ~3 g/cm³, Reference 1), it is assumed that the volume of displaced fuel will increase approximately six-fold when it resides in the sludge.
- Based on ultrasonic measurements of sludge depths in selected K East canisters (Reference 2), the "Working Estimate" of canister sludge volume is 3,000 liter. For the "Working Bound," the two sigma uncertainties of the measurements were used to calculate a value of 7,400 liter.

Sources

- References:
- (1) R. B. Baker, DESH, to G. L. Miller, NHC, and K. L. Silvers, PNNL, "Letter of Instruction (LOI): Part III for Detailed Laboratory Analyses of Sludge Samples Taken from K East Basin Fuel Storage Canisters," DESH-9654989, dated November 1, 1996.
 - (2) A. L. Pitner, *K East Canister Sludge Survey*, WHC-SD-SNF-TI-034, Rev. 0, dated August 1996.
 - (3) A. L. Pitner, *K East Fuel Cleanliness Evaluation*, WHC-SD-SNF-TI-018, Rev. 0, dated January 1996.

Calculation

Working Estimate

Canister Sludge Volume = 3,000 liter

Defected Fuel Volume = $(50,000) \times (0.38) \times (0.002 \text{ liter}) \times (2) = 76 \text{ liter}$

Bad Fuel Volume = $(50,000) \times (0.04) \times (1 \text{ liter}) \times (0.10) \times (6) = 1,200 \text{ liter}$

Total Volume = 4,300 liter

Working Bound

Canister Sludge Volume = 7,400 liter

Defected Fuel Volume = $(50,000) \times (0.38) \times (0.005 \text{ liter}) \times (2) = 190 \text{ liter}$

Bad Fuel Volume = $(50,000) \times (0.04) \times (1 \text{ liter}) \times (0.25) \times (6) = 3,000 \text{ liter}$

Total Volume = 10,600 liter