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1	SNF-6870	N/A	0	Effect of Canister Movement on Water Turbidity	Q	2	1	1

16. KEY

Approval Designator (F)	Reason for Transmittal (G)		Disposition (H) & (I)	
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		Design Agent	3		A.L. Bridges X3-85
1	1	Cog.Eng. D.J. Trimble D.J. Trimble 8-22-00 R3-86	3		B.J. Makenas H0-40
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1	1	QA D.W. Smith DW Smith 8/22/00 S2-48	3		A.L. Pajunen R3-86
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18.	19.	20.	21. DOE APPROVAL (if required)
D. J. Trimble 8-22-00 Signature of EDT Originator Date	J. R. Frederickson 8/22/00 Authorized Representative Date for Receiving Organization	J. R. Frederickson 8/22/00 Design Authority/ Cognizant Manager Date	Ctrl. No. [] Approved [] Approved w/comments [] Disapproved w/comments

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SNF-6870
Revision 0

Effect of Canister Movement on Water Turbidity

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

Fluor Hanford
P.O. Box 1000
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SNF-6870
Revision 0
EDT 629787

Effect of Canister Movement on Water Turbidity

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August 2000

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Fluor Hanford
P.O. Box 1000
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8/23/00

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List of Acronyms

Al	Aluminum
MCO	Multi-Cansiter Overpack
SNF	Spent Nuclear Fuel
SS	Stainless Steel

EFFECT OF CANISTER MOVEMENT ON WATER TURBIDITY

1.0 INTRODUCTION

Requirements for evaluating the adherence characteristics of sludge on the fuel stored in the K East Basin and the effect of canister movement on basin water turbidity are documented in Briggs (1996). The results of the sludge adherence testing have been documented (Bergmann 1996). This report documents the results of the canister movement tests.

2.0 TEST OBJECTIVES AND SCOPE

The purpose of the canister movement tests was to characterize water turbidity under controlled canister movements (Briggs 1996). The tests were designed to evaluate methods for minimizing the plumes and controlling water turbidity during fuel movements leading to multi-canister overpack (MCO) loading. It was expected that the test data would provide qualitative visual information for use in the design of the fuel retrieval and water treatment systems. Video recordings of the tests were to be the only information collected.

3.0 PROCEDURE

Canister movement test parameters, provided in the test plan (Briggs 1996), are as follows:

First canister

- Jog selected canister upward for 2 seconds and hold for 5 seconds to observe for canister bottom failure;
- If no failure, raise canister to just below upper limit using jog and pause intervals of 2 and 5 seconds, respectively;
- Hold canister for 30 seconds, allowing sludge plume to settle;
- Traverse canister at a slow, steady walking speed.

Subsequent canisters

- Vary the jog/pause intervals and traverse speeds to find optimal combination for minimizing formation of sludge plumes.

Eight canisters were selected for testing (Makenas 1996, Appendix A). Previous sludge depth measurements (in-canister and floor) as well as canister type and material provided the bases for the selections. These parameters are given in Appendix A for each canister tested.

Table 1 provides test parameters used in the tests. The canister vertical lift movements were usually a series of jog-pauses. The jogs were 1 to 2 seconds (s) long and the pauses were generally 10 to 20 seconds. A traverse (horizontal movement) of 6 to 12 feet followed a pause of 30 to 60 seconds. The canisters were tested with one or two traverse-return cycles.

4.0 RESULTS

The canister movement tests were performed on June 3, 1999, and the results were recorded on pages 3 to 5 of notebook WHC-N-1340-2 (Baker 1996) and on tapes from two video cameras. A videotape record of the tests is provided on Spent Nuclear Fuel (SNF) Characterization Video Tapes # 177 and 178, dated June 3, 1999. The time/date stamp on Tape #178 includes a 2H, distinguishing it from Tape #177. The date/time stamp for the cameras were out-of-sync by about one minute, with Tape #177 giving the earlier time. The videotapes were submitted to the SNF Project file for storage and retention.

Only qualitative data were available to describe the sludge plume and water turbidity resulting from the canister movements. Selected portions of the tests were documented by hard copy prints from the video. A summary of the results is provided in Table 1.

5.0 CONCLUSIONS

- Water turbidity usually occurred with the initial canister lifting movement.
- Fast traversing movements created more turbidity than slow movements for comparable canister conditions.
- Greater amounts of turbidity were observed for the slotted aluminum canisters, which contained large amounts of sludge.
- Turbidity cleared substantially within 1 or 2 minutes after movements were stopped.

6.0 REFERENCES

Baker, R. B., 1996, *K Basin Sludge/Fuel*, WHC-N-1340 2, Duke Engineering and Services, Handford, Richland, Washington.

Bergman, D. W., 1996, Sludge Adherence Summary Report, WHC-SD-SNF-TRP-015, Rev. 0, Duke Engineering and Services, Richland, Washington.

Briggs, W.A., 1996, *Test Plan for Sludge Removal Testing of the K-East Basin Fuel*, WHC-SD-SNF-TP-023, Rev.0, Duke Engineering and Services, Hanford, Richland, Washington.

Makenas, B.J., 1996, "Candidate Canisters for K East Basin Canister Movement Studies," Internal Memo to R.P. Omberg, dated May 22, 1996, Westinghouse Hanford Company, Richland, Washington (see Appendix A).

Table 1. Results of Canister Movement Tests in K East Basin (Baker 1996, and Video Tapes #177 and #178).

*Canister Location**	Vertical	Traverse Rate	Observation
3971	12 jogs	none	Sludge issued from bottom at moderate rate (Figure 1). Rate did not appear to be related to jogs.
	40 second pause then traverse	slow walk, ~0.16 ft/s	Sludge issued from bottom at decreasing a rate; it moved mostly downward and visibility was reduced to the 2 to 3 canisters in direct line with the plume Figure 2)
	none	return, ~0.34 ft/s	Light plume from bottom. Turbidity cleared in about 2 ½ minutes (Figure 3).
5445	lift not shown on video	normal handling rate, ~1.0 ft/s	A heavy plume resulted causing much turbidity. Visibility was significantly obstructed over the row of canisters traversed (Figure 4).
	30 second pause after return	none	Sludge continued to issue from bottom, and visibility of canisters traversed cleared considerably (Figure 5).
	lowered into slot	none	Turbidity cleared within 75 seconds of initial movement. Only minor effects on visibility remained.
6069	1st lift, 9 jogs	none	Minor plume resulted (Figure 6).
	none	0.38 ft/s	Minor plume causing slight turbidity that reduced as the 12 feet traverse progressed. Returned to slot with no visible turbidity after 1 minute from initiating traverse.
	2nd lift	none	minor plume
	none	1.15 ft/s	2nd traverse--Very minor plume including return trip. Visibility good after 50 seconds of initiating traverse.
	lowered into slot		Within 50 s visibility was good with minor turbidity remaining.
6757	9 jogs	none	Small plume issued from bottom during pauses (Figure 7).
	30 second pause	0.33 ft/s	Slight trail of sludge during traverse; small plume when traverse stopped and reversed (Figure 8).
	lowered into slot	return	No visible plume until return traverse stopped, plume had cleared within 90 seconds of initial movement.
	2nd lift	none	moderate plume
	none	0.95 ft/s	2nd traverse--Slight trail of sludge; moderate plume when traverse stopped and reversed.
		return	Returned to initial point within 20 seconds, most of plume not visible, minor turbidity remained (Figure 9).

Table 2. Results of Canister Movement Tests in K East Basin (Baker 1996, and Video Tapes #177 and #178) (continued).

Canister Location	**Vertical**	**Traverse Rate**	**Observation**
5618	8 jogs + 70 s pause	none	Moderate plume (Figure 10).
	none	0.32 ft/s	Small trailing plume.
	none	0.69 ft/s	Return churned up a plume from canisters passed over.
	lowered		Slight turbidity after 2 minutes (Figure 11).
2211	8 jogs	100 s pause	Moderate to heavy plume during lift and pause (Figure 12).
	none	0.3 ft/s	Moderate, decreasing plume.
	none	30 s pause	Small amounts of sludge continued to issue from bottom
	none	0.3 ft/s	Return--Light plume trail. Minor turbidity remaining at origin (Figure 13).
1236	7 jogs	none	Heavy plume with locally heavy turbidity.
	60 second pause	none	Sludge continued to issue from canister bottom.
	none	0.3 ft/s	Very little plume during traverse and return.
	30 second pause	none	No issue of sludge. Some turbidity at origin.
0668	7 jogs + 70 second pause	none	Moderate plume (Figure 14).
	none	0.3 ft/s	No visible plume (Figure 15).
	lowered	none	Some sludge issued as canister jostled into place.

*Shown in the sequence in which the canisters were tested.

Figure 1. Canister 3971 At End Of Initial Lift

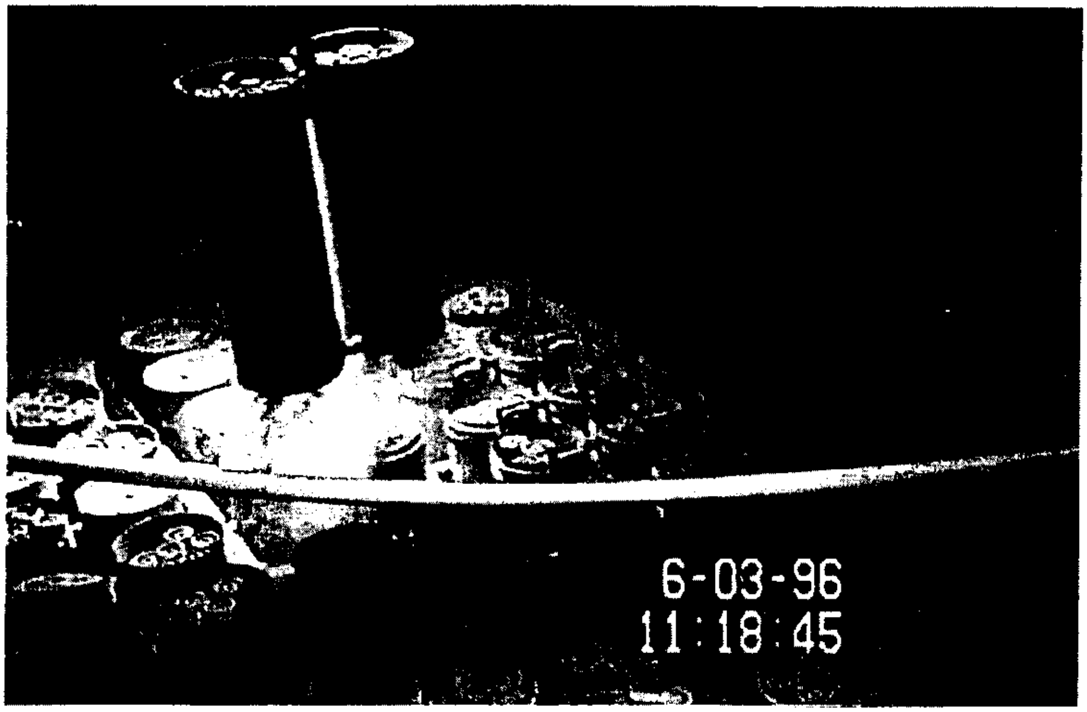

Figure 2. Initiating Traverse of Canister 3971

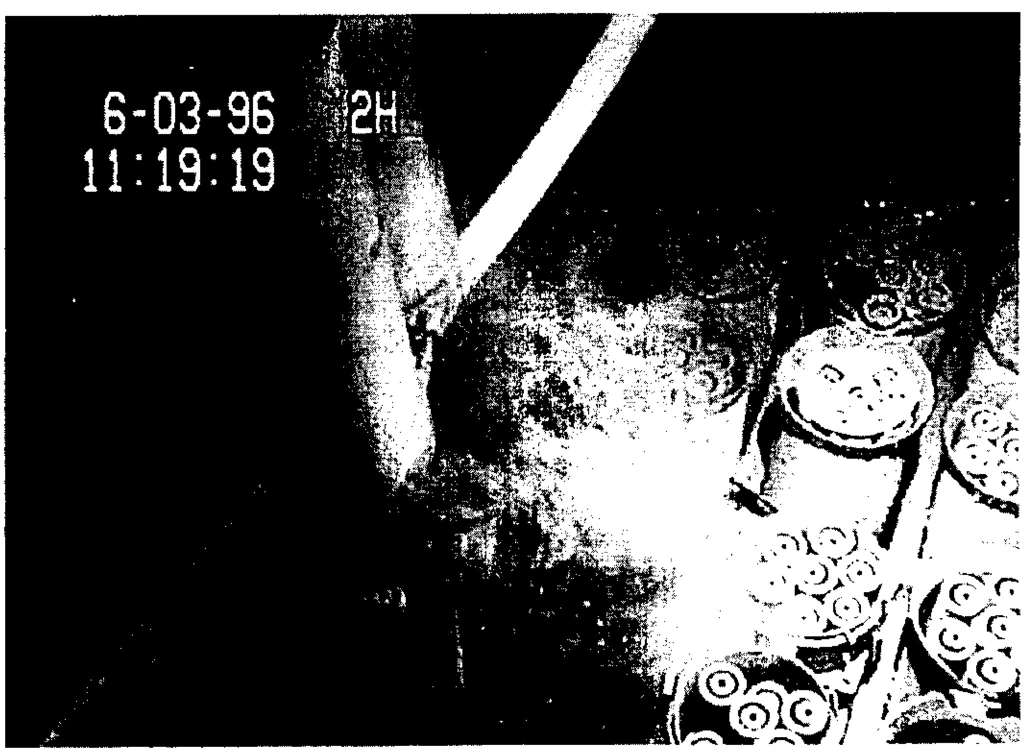

Figure 3. Canister 3971 At End Of Return From Traverse

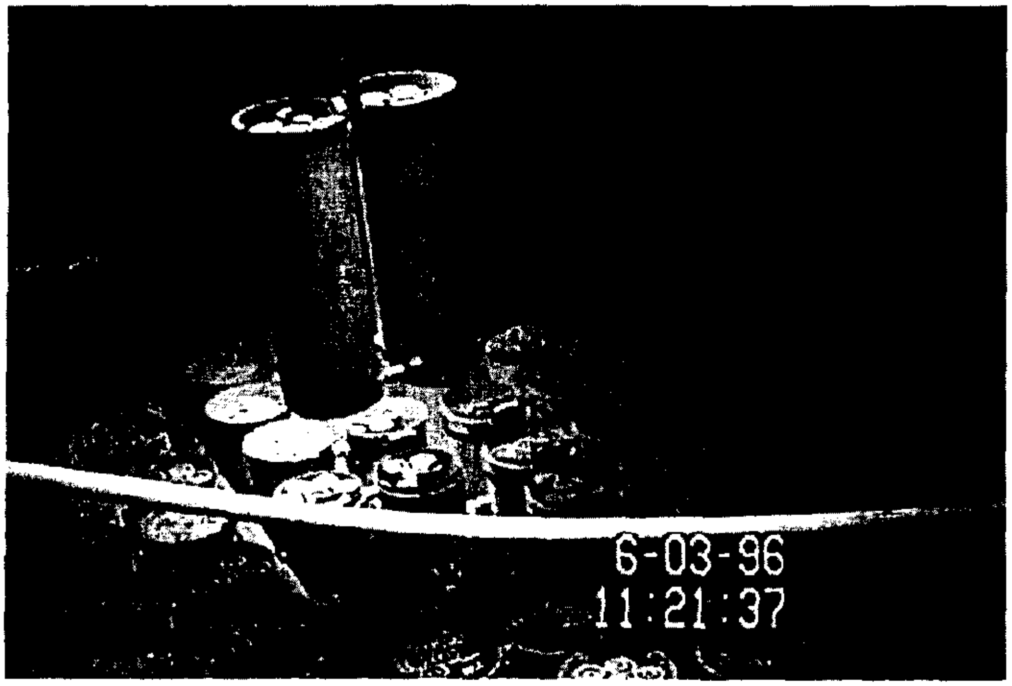

Figure 4. Canister 5445 During Return Traverse

Figure 5. Canister 5446 After 30 Second Pause At End Of Traverse

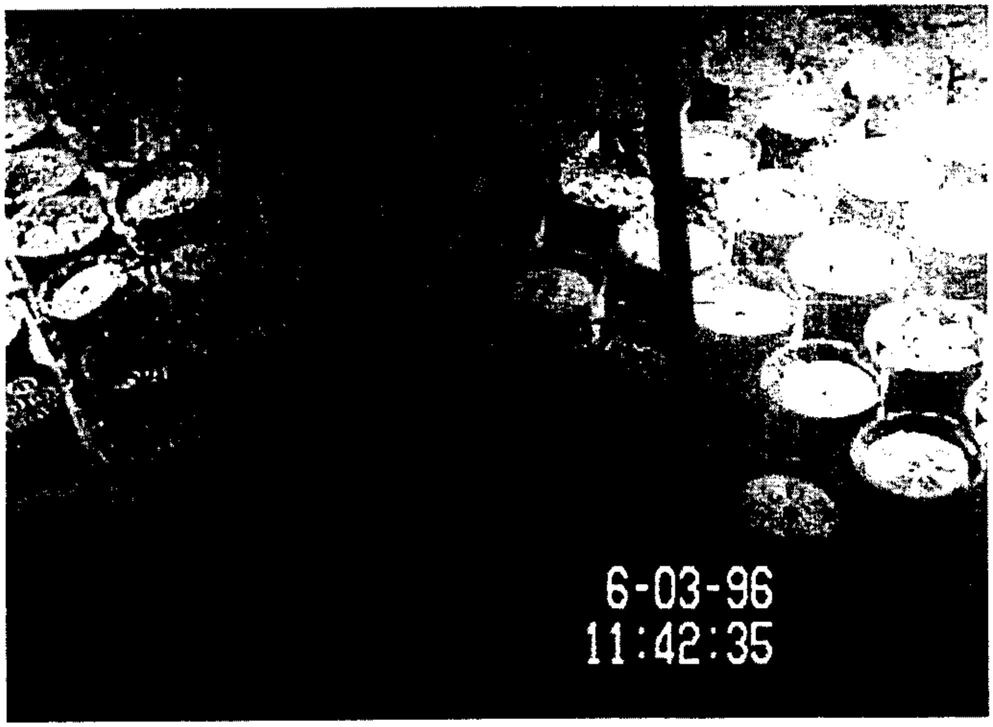

Figure 6. Canister 6069 At End Of 1st Lift

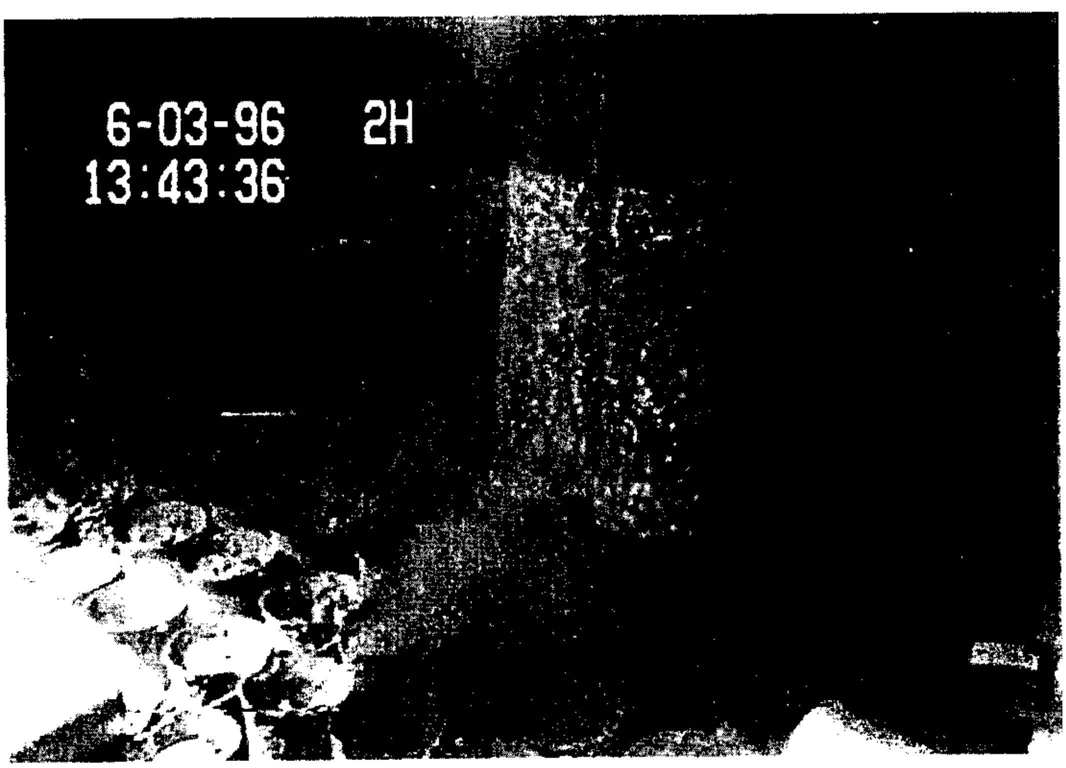

Figure 7. Canister 6757 At End Of 1st Lift

Figure 8. Traverse of Canister 6757

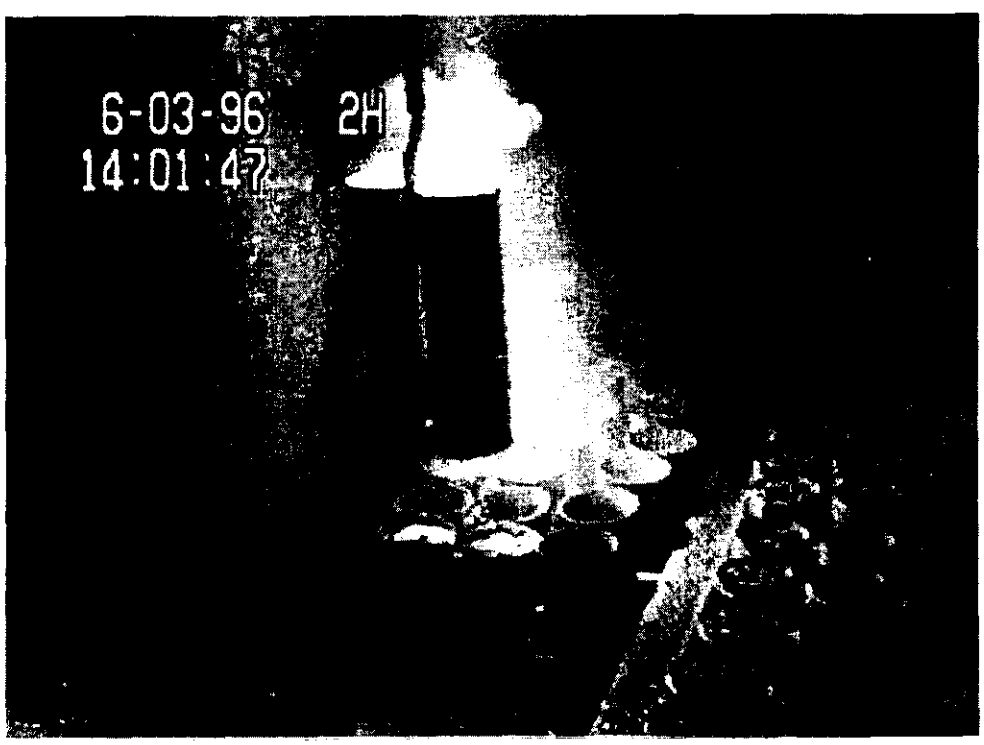

Figure 9. Canister 6757 Lowered Into Slot After Traverse

Figure 10. Canister 5618 At End Of Lift

Figure 11. Canister 5618 Being Lowered Into Slot Following Traverse

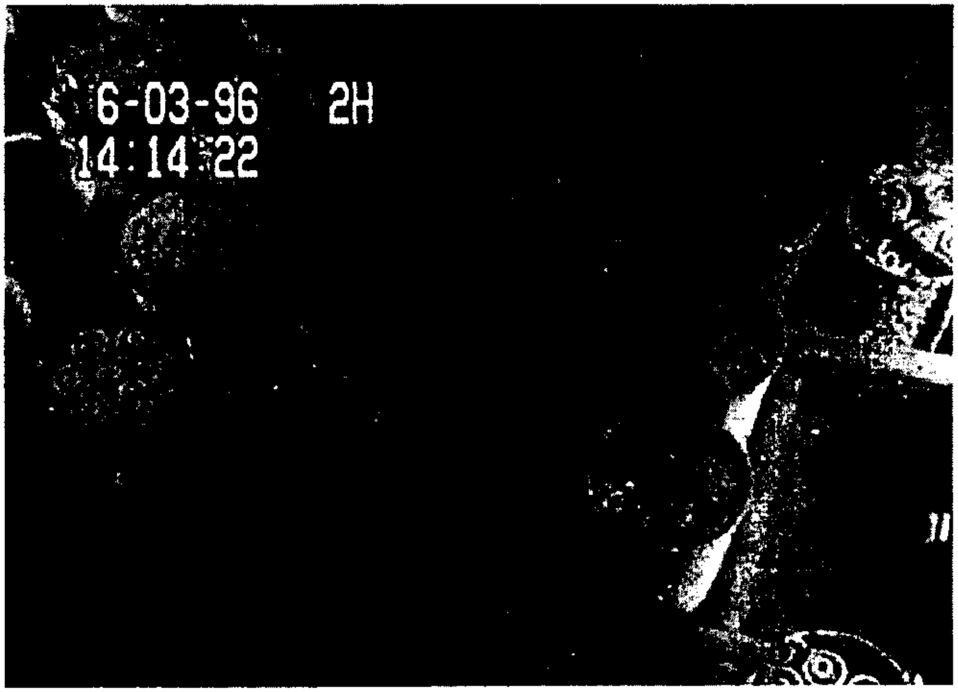

Figure 12. Start Of Traverse of Canister 2211

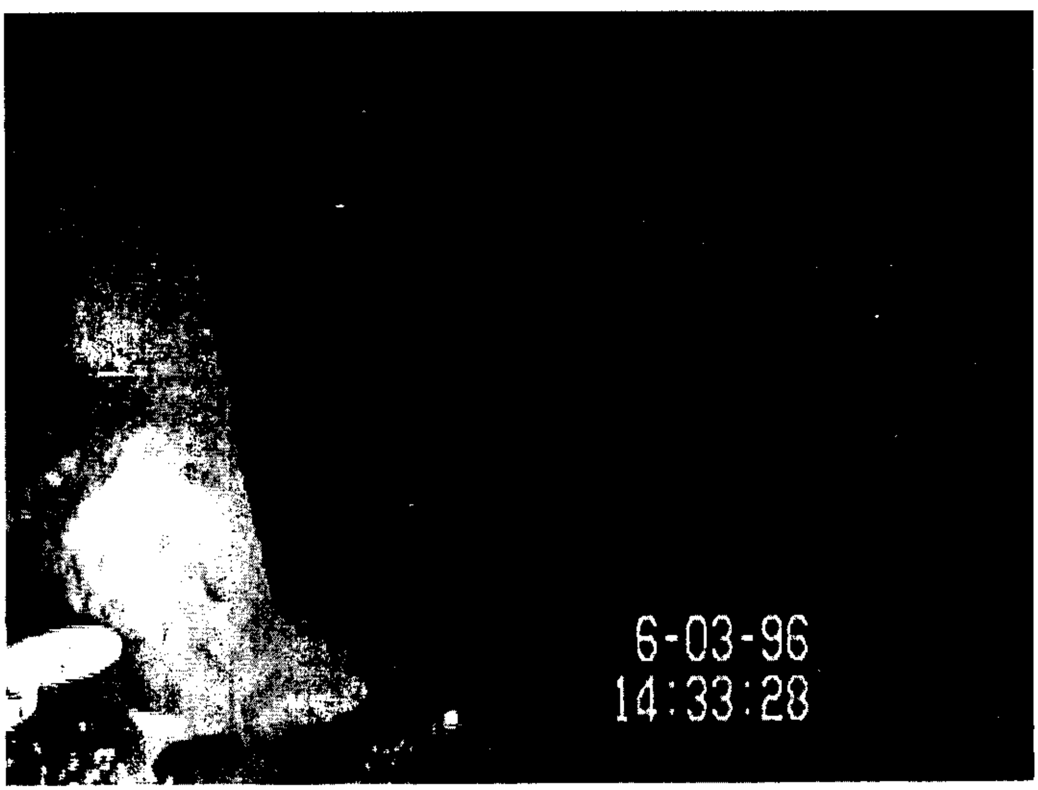

Figure 13. Canister 2211 Returning Traverse

Figure 14. Canister 0668 During Lift

Figure 15. End Of Return Traverse Of Canister 0668

APPENDIX A

Memo by B. J. Makenas

Westinghouse Hanford Company — **Internal Memo**

From: Spent Nuclear Fuel Evaluations
Phone: 376-5447 H0-40
Date: May 22, 1996
Subject: CANDIDATE CANISTERS FOR K EAST CANISTER MOVEMENT STUDIES

To: R. P. Omberg H0-40

cc:			
C. J. Alderman	R3-48	C. T. Miller	X3-72
R. B. Baker	H0-40	W. C. Mills	R3-85
G. Baston, MACTEC	R3-82	C. R. Miska	R3-86
D. W. Bergmann	R3-86	K. R. Morris	X3-67
A. E. Bridges	H0-40	K. L. Pearce	R3-48
B. S. Carlisle	R3-85	A. L. Pitner	H0-40
J. C. Fulton	R3-11	G. W. Reddick	H5-49
E. W. Gerber	R3-86	J. W. Serles, INFO	H0-40
J. J. Jernberg	X3-85	D. W. Siddoway	X3-71
L. A. Lawrence	H0-40	J. A. Swenson	R3-11
P. J. MacFarlan	H0-40	BJM File/LB	H0-40

Ultrasonic canister sludge measurements and floor sludge depth measurements were reviewed to obtain candidate canisters for canister movement studies. Movement of canisters at different speeds will be accomplished with video taping of the resulting dispersal of canister and floor sludge in the pool water. Parameters of interest are: (1) stainless steel canisters resting in deep and shallow floor sludge, (2) aluminum canisters containing deep and shallow canister sludge, and (3) at least one slotted canister. Note that it is not possible to determine with certainty from video records whether a non-slotted aluminum can has a screen or solid bottom. The attached table lists primary candidate canisters and a number of backups.

B. J. Makenas
Fellow Engineer

5/28/96
I finally did the distribution on this today when no one had ever shown up to pick it up.
BJM

jmn

Attachment

CONCURRENCE:

C. T. Miller — Date: 5/22/96
K Basin Operations

CANDIDATE CANISTERS FOR MOVEMENT STUDIES

Canister Location	Canister Sludge Depth (in.)	Floor Sludge Depth (in.)	Material	Comment
2211	4.02	1.5	Al	Deep in-canister sludge
6069	0.07	6.1	Al	Shallow in-canister sludge--deep floor sludge
5445	7.52	1.3	Al (slotted)	Deep in-canister sludge
668	3.23	4.9	SS	Deep floor sludge
3971	1.24	1.4	SS	Shallow floor sludge
1236	4.61	1.3	Al (slotted)	Backup Al canister
6757	11.07	4.2	SS	Backup, deep floor sludge
5618	0.85 to 1.53	1.1	SS	Backup, shallow floor sludge