U.S. Department of Energy
Hanford Site

20-AMRP-0005

NOV 27 2019

Dr. Laura C. Buelow, Program Manager
Office of Environmental Cleanup
Site Cleanup Unit 4
U.S. Environmental Protection Agency
825 Jadwin Avenue, Suite 210
Richland, Washington 99352

Dear Dr. Buelow:

COMPLETION OF HANFORD FEDERAL FACILITY AGREEMENT AND CONSENT ORDER (TRI-PARTY AGREEMENT) MILESTONE M-016-176

This letter documents completion of Tri-Party Agreement Milestone M-016-176, "Complete Sludge Removal from 105-KW Fuel Storage Basin," due December 31, 2019.

The Engineered Container Retrieval and Transfer System processing campaign operated between May 2018 and September 2019, concluding when the twentieth Sludge Transport and Storage Container was placed in storage at T Plant on September 11, 2019. The volume remaining in each engineered container meets the end-point criteria as noted in the Attachment.

If there are any questions, please contact me or your staff may contact Mark French, of my staff, on (509) 373-9863.

Sincerely,

William F. Hamel, Assistant Manager
for the River and Plateau
Richland Operations Office

AMRP:KLH

Attachment:
Letter CHPRC-1904767

cc: See page 2

cc w/attach:
S. G. Austin, CHPRC
J. Bell, NPT
S. L. Brasher, MSA
R. Buck, Wanapum
L. Contreras, YN
S. W. Davis, MSA
D. R. Einan, EPA
R. M. Geimer, CHPRC
M. Johnson, CTUIR
S. Leckband, HAB
N. M. Menard, Ecology
K. Niles, ODOE
M. Pakula, Ecology
S. N. Schleif, Ecology
A. K. Smith, Ecology
Administrative Record (M-016-176)
Environmental Portal

CH2MHILL
Plateau Remediation Company
a Jacobs company

CH2M HILL
Plateau Remediation Company
PO Box 1600
Richland, WA
99352

November 14, 2019

CHPRC-1904767

Ms. Jenise C. Connerly, Contracting Officer
U.S. Department of Energy
Richland Operations Office
Post Office Box 550
Richland, Washington 99352

Dear Ms. Connerly:

CONTRACT NUMBER DE-AC06-08RL14788 – NOTIFICATION OF COMPLETION OF HANFORD FEDERAL FACILITY AGREEMENT AND CONSENT ORDER, MILESTONE M-016-176, "COMPLETE SLUDGE REMOVAL FROM 105KW FUEL STORAGE BASIN"

References:

1. DOE/RL-2010-107, Rev. 0, *105-K West Basin Qualified Process and Plan to Satisfy End-Point Criteria (Fuel, Sludge, and Below-Water Debris),* dated January 2011.

2. PRC-KC-CN-N-00048, Rev. 0, *End-Point Criteria Calculations of Allowable Sludge Residual in Engineered Containers (ECs)*, CHPRC, Richland, Washington.

The purpose of this letter is to communicate the completion of Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) milestone M-016-176, "Complete Sludge Removal from 105-KW Fuel Storage Basin," as defined in the Tri-Party Agreement, Appendix D.

DOE/RL-2010-107, Revision 0, *105-K West Basin Qualified Process and Plan to Satisfy End-Point Criteria (Fuel, Sludge, and Below-Water Debris),* Section 4.3.1.2, "End-Point Criteria No. 2 for Sludge Removal" item 3 states (Reference 1):

> *"Retrieve sludge from the engineered containers (ECs) to the sludge transfer and storage containers (STSCs). Remove the STSCs with sludge from the basin, basin building and reactor building to a location that will allow complete basin deactivation. This constitutes sludge removal from the basin."*

The Engineered Container Transfer and Storage System (ECRTS) processing campaign began operations in May 2018 and concluded in September 2019 when the 20th and final sludge storage and transfer container was placed safely in shielded storage at T Plant on September 11, 2019.

The removal of the sludge from the six engineered containers to the end-point criteria presented in Reference 2, constitutes the objective quality evidence required to support completion of Tri-Party Agreement milestone M-016-176.

Following the cleanout of each of the six engineered containers, a 100K Work Team performed video inspections to assess the final volume within each engineered container. The results of these inspections

are within the work document record and also published collectively in PRC-STP-01122, Revision 0, *Engineered Container Retrieval and Transfer System Campaign Report* (attached), as summarized below.

Final Volumes of Sludge in Engineered Containers

Engineered Container	End Point Criteria from PRC-KC-CN-N-00048	Remaining Sludge Volume from 1E-18-04301
SCS-CON-210	46 gallons	18 gallons
SCS-CON-220	13 gallons	3.5 gallons
SCS-CON-230	3.0 gallons	2.1 gallons
SCS-CON-240	55 gallons	13.9 gallons
SCS-CON-250	55 gallons	34 gallons
SCS-CON-260	55 gallons	37.8 gallons

Sludge has been removed from all six engineered containers to a level that exceeds the final end-point criteria and satisfies DOE/RL-2010-107, Rev. 0, Section 4.3.1.2, "End-Point Criteria No. 2 for Sludge Removal", item 3 and Tri-Party Agreement milestone M-016-176.

Technical questions should be directed to R. M. Geimer at 373-1713, and contractual questions should be directed to S. W. Bork at 376-5212.

Sincerely,

L. Ty Blackford
President and
Chief Executive Officer

jms/cmg

Attachment

RL - M. S. French
L. K. Jarnagin
B. S. Valadez
H. R. Weber
A. H. Wirkkala

Electronically Approved by:

UserName: Blackford, Ty (Leonard) (h0074390)
Title: President and Chief Executive Officer
Date: Thursday, 14 November 2019, 04:05 PM Pacific Time
Meaning: Sign as L. Ty Blackford
==========

PRC-STP-01122
Revision 0

Engineered Container Retrieval and Transfer System Campaign Report

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

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

CH2MHILL
Plateau Remediation Company

P.O. Box 1600
Richland, Washington 99352

Approved for Public Release;
Further Dissemination Unlimited

PRC-STP-01122
Revision 0
EDC#: ECR-19-001386

Engineered Container Retrieval and Transfer System Campaign Report

Document Type: RPT Program/Project: STP

J. M. St. Germaine
CH2M HILL Plateau Remediation Company

Date Published
October 2019

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

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

CH2MHILL
Plateau Remediation Company
P.O. Box 1600
Richland, Washington 99352

DATE:
Sep 30, 2019
HANFORD RELEASE

APPROVED
By Lynn M. Ayers at 11:49 am, Sep 30, 2019

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Total pages: 136

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Acronyms

105KE	105KE Reactor Spent Fuel Basin
105KW	105KW Reactor Spent Fuel Basin
ARA	Airborne Radioactivity Area
CA	Control Area
CHPRC	CH2M HILL Plateau Remediation Company
DOE	U.S. Department of Energy
ECRTS	Engineered Container Retrieval and Transfer System
HCA	High Contamination Area
MASF	Maintenance and Storage Facility
SNF	Spent Nuclear Fuel
SSM	Segregated Settler Material
STP	Sludge Treatment Project
STSC	Sludge Transport and Storage Containers

1.0 Introduction

As stated in KBC-30811, *Sludge Treatment Project – Project Execution Plan*, and per HNF-34695, *Sludge Treatment Project Mission Need Statement – Project A-21C*, the Sludge Treatment Project's (STP's) mission is to design, procure, construct, test, commission, and operate an integrated set of processes/systems to:

- Remove radioactive sludge currently stored in the 105KW Reactor Spent Fuel Basin (105KW Basin) to enable the achievement of the U.S. Department of Energy's (DOE's) 2015 Vision for the Columbia River Corridor and waste consolidation on the 200 Area Central Plateau (Phase 1), and
- Process and package the sludge in approved containers suitable for transportation to a national repository (Phase 2).

Radioactive "sludge" accumulated in the 105KE Reactor Spent Fuel Basin (105KE Basin) and the 105KW Basin from the degradation of spent metallic uranium nuclear fuel stored at these facilities. To facilitate the decontamination and decommissioning of the 105KE and 105KW Reactors and facilities on the Hanford Site, this sludge was collected at the 105KW Basin in specially designed Engineered Containers (ECs).

The STP Phase 1 process for removing the sludge from the ECs and transferring to T Plant for interim storage was the Engineered Containers Retrieval and Transfer System (ECRTS) Process. The ECRTS process facilitated longer term storage of the sludge by hydraulically retrieving and transferring the sludge from the ECs to new specially engineered stainless-steel Sludge Transport and Storage Containers (STSCs). The sludge-filled STSCs were then transported via shielded cask to T Plant for interim storage in preparation for STP Phase 2.

This campaign report provides a collection of information obtained during the Phase 1 removal of EC sludge from 105KW Basin. Sludge retrieval began in May of 2018 and completed on September 11, 2019, when the last STSC was placed in shielded storage at T Plant.

2.0 Scope

This document (here in referred to as the Campaign Report) provides a high level summary of the sludge removal campaign. This document provides details of the sludge retrieval from six ECs located in the 105KW Basin, as well as the final disposition of each STSC and EC.

3.0 Sludge Inventory/Description

Approximately 27 m^3 of sludge was collected and consolidated at the 105KW Basin in six specially designed ECs. The sludge was stored in ECs under water at the 105KW Basin for radiation shielding and airborne contamination control. Table 3-1 presents the estimated volumes of sludge within each of the ECs (per HNF-SD-SNF-TI-015, *Spent Nuclear Fuel Project Technical Databook, Volume 2, Sludge*, Table 3-1).

Table 3-1. Estimated Volumes of Sludge in Engineered Containers[1]

	KW Originating		Settler Tank	KE Originating		
Engineered Container	**SCS-CON-210[2]**	**SCS-CON-220[2]**	**SCS-CON-230[2]**	**SCS-CON-240[2]**	**SCS-CON-250[2]**	**SCS-CON-260[2]**
Average Sludge Depth[3]	4.2 ft.	2.3 ft.	3.75 ft.	3.25 ft.	6.2 ft.	6.5 ft.
Volume[4]	4.2 m^3	1.0 m^3	3.5 m^3	2.6 m^3	7.7 m^3	8.1 m^3

Notes:

1. CHPRC-1301317, Interoffice Memorandum, *Determination of Sludge Volume in the KW Basin Containers SCS-CON-210, SCS-CON-220, SCS-CON-230, SCS-CON-240, SCS-CON-250, and SCS-CON-260 for the 2012 Biennial Sludge Inventory*, M.T. Bachand, D.D. Craig and J.F. Thompson, Jr., April 2, 2013
2. Measurement from September 19 & 20, 2012
3. The sludge volumes in the table are approximations based on interpretation of average sludge depth. The addition of 25.4 L of Segregated Settler Material into Engineered Container SCS-CON-220 is within the accuracy of the original sludge volume estimate of 1.0 m3
4. Measurement scales inside the Containers read distance referenced to basin floor. The bottoms of the SCS-CON containers are 6 inches above the floor. The average sludge depth in each container is relative to the basin floor. Average sludge depth assumes mounds are averaged over container.

4.0 Operating Sequence

A detailed description of each activity and the operations sequence for the STP ECRTS Process can be found in PRC-STP-00358, *Operating Sequence and Interlock Definition Document for the Sludge Treatment Project Engineered Container Retrieval and Transfer System.* In summary, the STP ECRTS Process was a repetitive batch process that involved the following tasks:

1. Routine line ups (Electrical and Mechanical)
2. Receive and Prepare STSC
3. Sludge Retrieval and Transfer to STSC
4. Flush Transfer Line to STSC
5. Settle Sludge in STSC
6. Decant and Filter Supernatant from STSC

(Process tasks 3 – 6 above were repeated, as required, to fill an STSC with sludge)

7. Backwash Sand Filter to STSC (performed after each EC layer in STSC or as needed to improve sand filter performance)
8. Clean Transfer or Decant Line (Pigging–Off-Normal Task)
9. Remove Excess Sludge from STSC (Overfill Recovery–Off-Normal Task)
10. Disconnect Piping and Inert STSC
11. Inert STS Cask and Ship

It should be noted that Pigging (Item 8 above) and Overfill Recovery (Item 9 above) were recovery activities that were not required to be performed during the ECRTS Campaign.

5.0 ECRTS Campaign Summary

Following successful completion of Testing, Start-up, and Readiness activities, 100K Operations was authorized to begin transferring material from ECs to STSCs. Each STSC was processed following the general process steps identified in Section 4.0. Table 5-1 summarizes the processing of EC sludge and provides its interim storage area inside T Plant. Appendix A provides a graphical representation of the retrievals from each of the respective ECs.

Table 5-1. ECRTS Campaign Summary

Engineered Container And initial volume estimate (m^3)	STSCs # for emptying EC	STSC Sequence #	T-Plant Cell Location (Process Cell / Cell Position #)	Associated STSC Traveler Documentation	Bulk Retrieval Criteria (gal)	End Point Criteria (gal) (PRC-KC-CN-N-00048)	Current EC Remaining Sludge Volume Estimate (from 1E-18-04301)	Estimated EC Cleanout Efficiency[1]
SCS-CON-210 4.3 m^3	1. ECRT-CON-W-418 2. ECRT-CON-W-424 3. ECRT-CON-W-421 4. ECRT-CON-W-420 5. ECRT-CON-W-405	1. STSC #1 2. STSC #2 3. STSC #3 4. STSC #4 5. STSC #17	1. 10L #5 2. 10L #3 3. 10L #6 4. 15L #3* 5. 13L #2	1. PRC-STP-01097 2. PRC-STP-01103 3. PRC-STP-01100 4. PRC-STP-01099 5. PRC-STP-01084	75	46	18 gallons See Appendix B	98.4%
SCS-CON-220 1.12 m^3	1. ECRT-CON-W-401 2. ECRT-CON-W-416	1. STSC #15 2. STSC #16	1. 14R #3 2. 13L #1	1. PRC-STP-01080 2. PRC-STP-01095	75	13	3.5 gallons See Appendix B	99.0%
SCS-CON-230 3.02 m^3	1. ECRT-CON-W-404 2. ECRT-CON-W-411 3. ECRT-CON-W-413 4. ECRT-CON-W-412 5. ECRT-CON-W-402 6. ECRT-CON-W-406 7. ECRT-CON-W-410 8. ECRT-CON-W-422 9. ECRT-CON-W-419 10. ECRT-CON-W-415 11. ECRT-CON-W-408	1. STSC #5 2. STSC #6 3. STSC #7 4. STSC #8 5. STSC #9 6. STSC #10 7. STSC #11 8. STSC #12 9. STSC #14 10. STSC#19 11. STSC #20	1. 15L #6 2. 15L #5 3. 15L #4 4. 15L #2 5. 15L #1 6. 14R #1 7. 14R #2 8. 14R #4 9. 14R #6 10. 13L #5 11. 13L #6	1. PRC-STP-01083 2. PRC-STP-01090 3. PRC-STP-01092 4. PRC-STP-01091 5. PRC-STP-01081 6. PRC-STP-01085 7. PRC-STP-01089 8. PRC-STP-01101 9. PRC-STP-01098 10. PRC-STP-01094 11. PRC-STP-01087	75	3.0	2.1 gallons See Appendix B	99.8%

Table 5-1. ECRTS Campaign Summary

Engineered Container And initial volume estimate (m^3)	STSCs # for emptying EC	STSC Sequence #	T-Plant Cell Location (Process Cell / Cell Position #)	Associated STSC Traveler Documentation	Bulk Retrieval Criteria (gal)	End Point Criteria (gal) (PRC-KC-CN-N-00048)	Current EC Remaining Sludge Volume Estimate (from 1E-18-04301)	Estimated EC Cleanout Efficiency[1]
SCS-CON-240 2.6 m^3	1. ECRT-CON-W-403 2. ECRT-CON-W-415 3. ECRT-CON-W-408	1. STSC #18 2. STSC #19 3. STSC #20	1. 13L #3 2. 13L #5 3. 13L #6	1. PRC-STP-01082 2. PRC-STP-01094 3. PRC-STP-01087	75	55	13.9 gallons See Appendix B	98.0%
SCS-CON-250 7.7 m^3	1. ECRT-CON-W-404 2. ECRT-CON-W-411 3. ECRT-CON-W-413 4. ECRT-CON-W-412 5. ECRT-CON-W-402 6. ECRT-CON-W-406 7. ECRT-CON-W-410	1. STSC #5 2. STSC #6 3. STSC #7 4. STSC #8 5. STSC #9 6. STSC #10 7. STSC #11	1. 15L #6 2. 15L #5 3. 15L #4 4. 15L #2 5. 15L #1 6. 14R #1 7. 14R #2	1. PRC-STP-01083 2. PRC-STP-01090 3. PRC-STP-01092 4. PRC-STP-01091 5. PRC-STP-01081 6. PRC-STP-01085 7. PRC-STP-01089	75	55	34 gallons See Appendix B	98.4%
SCS-CON-260 8.1 m^3	1. ECRT-CON-W-410 2. ECRT-CON-W-422 3. ECRT-CON-W-423 4. ECRT-CON-W-419 5. ECRT-CON-W-416 6. ECRT-CON-W-405 7. ECRT-CON-W-403	1. STSC #11 2. STSC #12 3. STSC #13 4. STSC #14 5. STSC #16 6. STSC #17 7. STSC #18	1. 14R #2 2. 14R #4 3. 14R #5 4. 14R #6 5. 13L #1 6. 13L #2 7. 13L #3	1. PRC-STP-01089 2. PRC-STP-01101 3. PRC-STP-01102 4. PRC-STP-01098 5. PRC-STP-01095 6. PRC-STP-01084 7. PRC-STP-01082	75	55	37.8 gallons See Appendix B	98.4%

* STSC #4 ECRT-CON-W-420 was originally installed in T Plant Process Cell 15L Cell Position #1 per the traveler paperwork but was later moved to Process Cell 15L Cell Position #3

[1] EC Clean out efficiency is based on the total amount of Buoyant weight removed and the difference between initial estimated volume and final estimated volume in EC.

5.1 Operating Schedule

The 100K Operations schedule for the ECRTS Processing was day shift (4 × 10 hr/day). The operations team used a combination of holdovers (greater than 10 hrs per day) and planned weekend work to strategically hold schedule. Figure 5-1 provides a summary view of the start and ship dates for each STSC. Figure 5-2 provides a summary, by task of the ECRTS operation, including brief descriptions for any delays in the processing of each STSC.

ID	Task Name	Start	Finish
1	STSC #1	Thu 5/24/18	Mon 6/25/18
2	STSC #2	Tue 6/26/18	Mon 8/6/18
3	STSC #3	Tue 8/7/18	Tue 9/4/18
4	STSC #4	Wed 9/5/18	Thu 9/27/18
5	STSC #5	Fri 9/28/18	Wed 10/31/18
6	STSC#6	Thu 11/1/18	Mon 11/26/18
7	STSC#7	Tue 11/27/18	Mon 12/17/18
8	STSC #8	Tue 12/18/18	Fri 1/11/19
9	STSC #9	Mon 1/14/19	Mon 2/25/19
10	STSC #10	Tue 2/26/19	Mon 3/18/19
11	STSC #11	Tue 3/19/19	Wed 4/10/19
12	STSC #12	Thu 4/11/19	Wed 4/24/19
13	STSC #13	Thu 4/25/19	Tue 5/7/19
14	STSC #14	Wed 5/8/19	Mon 5/20/19
15	STSC #15	Tue 5/21/19	Mon 6/10/19
16	STSC #16	Tue 6/11/19	Tue 6/25/19
17	STSC #17	Wed 6/26/19	Thu 7/18/19
18	STSC #18	Fri 7/19/19	Mon 8/5/19
19	STSC #19	Tue 8/6/19	Mon 8/19/19
20	STSC #20	Tue 8/20/19	Mon 9/9/19

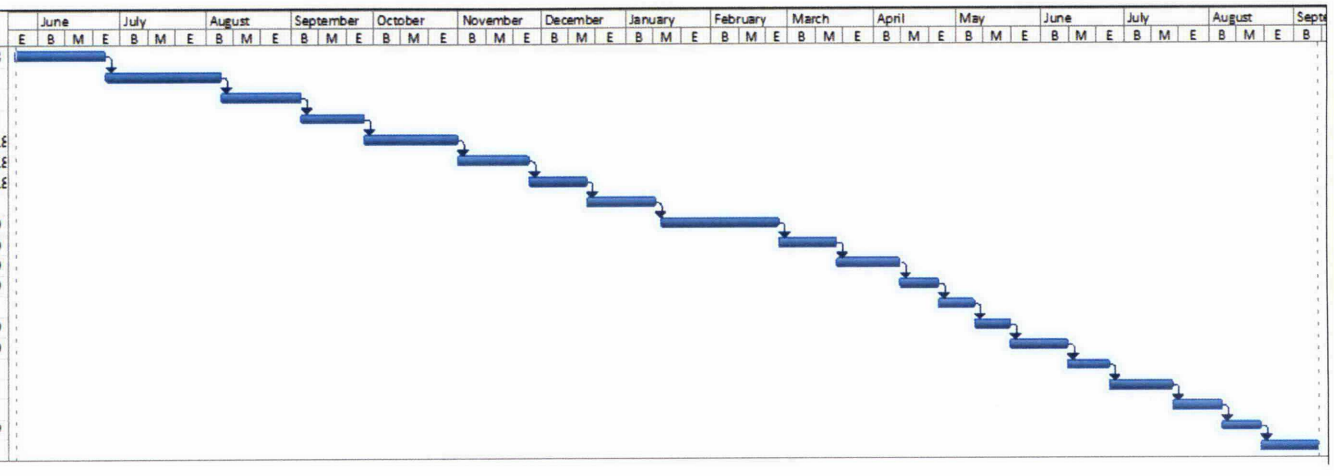


Figure 5-1. Start and Ship Dates for Sludge Processing

STSC Performance Tracking

STSC #	Sludge Source	Working Days (Including OT)																									Issues, Delays, Comments
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
1st STSC Cask 1 418	210 - 875lbs 107%	24-May	29-May	30-May	31-May	1-Jun	4-Jun	5-Jun	6-Jun	7-Jun	8-Jun	11-Jun	12-Jun	13-Jun	14-Jun	15-Jun	18-Jun	19-Jun	20-Jun	21-Jun	22-Jun	25-Jun	26-Jun	27-Jun	28-Jun	2-Jul	* Lost ~4 days to procedure changes * (CM) Lost 1 Partial day due to issue with crane and implementation of recovery plan. * Lost 1 day due to stop work for observer interference in work activities * Lost 1 day due to stop work on XAGO tool movement due to concerns on ergonomics *(CM) Lost 1 day to execute recovery plan for XAGO Move * Lost 1 day due to stop work on Respiratory Protection * Lost 1 day due to stop work on Hard Hat Use with Respiratory Protection. * Lost 1 day due to issues with Leak Test
2nd STSC Cask 1 424	210 - 776 lbs 95%	11-Jul	12-Jul	13-Jul	16-Jul	17-Jul	18-Jul	19-Jul	23-Jul	24-Jul	25-Jul	26-Jul	30-Jul	31-Jul	1-Aug	2-Aug	3-Aug	6-Aug	7-Aug	8-Aug	9-Aug	13-Aug					* Start Date Delayed by maintenance, transfer of high dose material into engineered container, and 4th of July Holiday * (CM) Lost 1 day to repair Vent Port 1 sealing surface * (CM) Lost partial day due to XAGO reconnect and retest following High Dose Material * Lost 2 days for implementation of recovery actions when void limit of RWP was exceeded * Lost 1 day for Facility Stop work on RWPs * Lost 2 partial days for field changes to procedures
3rd STSC Cask 1 421	210 - 716lbs 88%	14-Aug	15-Aug	16-Aug	17-Aug	20-Aug	21-Aug	22-Aug	23-Aug	24-Aug	27-Aug	28-Aug	4-Sep	5-Sep	6-Sep	7-Sep	10-Sep										*(CM)Lost 1.5 day to for repair of Oxygen Analyzer, calibration of equipment, and replacement of Rupture Disk spool. *Shipment Delayed for Labor Day Holiday from Aug 29 to Sept 4.
4th STSC Cask 1 420	210 - 724 lbs 89%	10-Sep	11-Sep	12-Sep	14-Sep	15-Sep	17-Sep	18-Sep	19-Sep	20-Sep	24-Sep	25-Sep	26-Sep	27-Sep	1-Oct	2-Oct	3-Oct	4-Oct									*Lost 3/4 day to complete maintenance activities. *Lost 1/2 day for EP Drill. *Lost 1/2 day to address vapor concern in basin during transfer *Lost 1/2 day due to insufficient personnel available to complete transfer *Lost 1/2 day to determine path for after sludge transfer yields dropped off (End Point Criteria Inspection).
5th STSC Cask 1 404	230 - 617 lbs 250 - 1562 lbs 90%	8-Oct	9-Oct	10-Oct	11-Oct	15-Oct	16-Oct	17-Oct	18-Oct	19-Oct	22-Oct	23-Oct	24-Oct	25-Oct	26-Oct	29-Oct	30-Oct	31-Oct									*Lost 4 days due to XAGO relocation and recovery actions. *Lost 1/2 day for XAGO leak test following task 1 NOTE: CASK#2 placed in service following STSC #5. TPlant processing days will no longer be tracked unless they affect ECRTS Processing at 100K.
6th STSC Cask 2 411	230 - 654 lbs 250 - 1601 lbs 93%	1-Nov	2-Nov	5-Nov	6-Nov	7-Nov	8-Nov	9-Nov	12-Nov	13-Nov	14-Nov	15-Nov	19-Nov	20-Nov	26-Nov												*Lost 1/2 day for EP Drill *Lost 1 day for Vent Port Seal removal *Lost 1/2 day for Continuing training *Shipment pushed to November 26 for Thanksgiving Holiday.

Figure 5-2. Schedule Analysis for Sludge Processing

STSC Performance Tracking

STSC #	Sludge Source	Working Days (Including OT) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Issues, Delays, Comments
7th STSC Cask 1 413	230 - 743 lbs 250 - 1599 lbs 96%	27-Nov	28-Nov	29-Nov	30-Nov	3-Dec	4-Dec	5-Dec	6-Dec	10-Dec	11-Dec	12-Dec	13-Dec	14-Dec	17-Dec												*Lost 1/2 day for spill response recovery actions when oil was found on floor. *Lost 1 day to replace Lid seal on STSC after damage was found during inspection. *Lost 1/2 day for recovery plan following electrical outage.
8th STSC Cask 2 412	230 - 694 lbs 250 - 1621 lbs 95%	18-Dec	19-Dec	20-Dec	21-Dec	26-Dec	27-Dec	31-Dec	2-Jan	3-Jan	4-Jan	7-Jan	8-Jan	9-Jan	10-Jan	11-Jan											*Lost 1 day to replace Lid Rubber O-ring. *Lost 1 day to troubleshoot panel communication issues. *Lost 1/2 day for recovery plan to replace drain port seal.
Maint. Outage		14-Jan	15-Jan	16-Jan	17-Jan	18-Jan	21-Jan	22-Jan																			
9th STSC Cask 1 402	230 - 638 lbs 250 - 1510 lbs 88%	23-Jan	24-Jan	25-Jan	28-Jan	29-Jan	30-Jan	31-Jan	1-Feb	4-Feb	5-Feb	6-Feb	7-Feb	11-Feb	12-Feb	13-Feb	14-Feb	19-Feb	20-Feb	21-Feb	22-Feb	23-Feb	25-Feb				*Lost 1/4 day issues with the installation of the drain port tool *Lost 1/4 day for administrative issue with Sentinel *Lost 4 days for Tplant Crane maintenance *Lost 4 days for weather delays *Lost 2 days to recover from drain port seal issue
10th STSC Cask 2 406	230 - 766 lbs 250 - 1506 lbs 91%	26-Feb	27-Feb	28-Feb	1-Mar	4-Mar	5-Mar	6-Mar	7-Mar	8-Mar	11-Mar	12-Mar	13-Mar	14-Mar	15-Mar	16-Mar	18-Mar										*Lost 2.5 days due to leaking IXM *Lost 2.5 days due to weather delays *Lost 1/2 day for recovery plan following I-3 alarm during transfer.
11th STSC Cask 1 410	230 - 766 lbs 250 - 315 lbs 260 - 1164 lbs 93%	19-Mar	20-Mar	21-Mar	22-Mar	25-Mar	26-Mar	27-Mar	28-Mar	29-Mar	1-Apr	2-Apr	3-Apr	4-Apr	5-Apr	8-Apr	9-Apr	10-Apr									*Lost 1 day to support Fire System Maintenance at 105KW Annex *Lost 3 days to resolve failed leak test.
12th STSC Cask 2 422	230 - 643 lbs 260 - 1035 lbs 69%	11-Apr	12-Apr	13-Apr	15-Apr	16-Apr	17-Apr	18-Apr	19-Apr	22-Apr	23-Apr	24-Apr															*Lost 1/2 day for EP Drill *Lost 1/2 day for Safety Expo
13th STSC Cask 1 423	260 - 1034 lbs 48%	25-Apr	26-Apr	27-Apr	29-Apr	30-Apr	1-May	2-May	3-May	6-May	7-May																No noted issues, delays, or comments.
14th STSC Cask 2 419	230 - 288 lbs 260 - 1043 lbs 55%	8-May	9-May	10-May	11-May	13-May	14-May	15-May	16-May	17-May	20-May																*Lost 1 day for plugged line in Train A *Lost 1/2 day for drain port seal replacement.
15th STSC Cask 1 401	220 - 1031 lbs 72%	21-May	22-May	23-May	28-May	29-May	30-May	31-May	1-Jun	3-Jun	4-Jun	5-Jun	6-Jun	7-Jun	10-Jun												* Lost 1 day due to Maintenance activity that took a day longer than expected (Annex Stack Monitoring Line Inspection) * Lost 1/2 day for Stop Work in the Basin due to lighting
16th STSC Cask 2 416	220 - 95 lbs 260 - 1084 lbs 64%	11-Jun	12-Jun	13-Jun	14-Jun	15-Jun	17-Jun	18-Jun	19-Jun	20-Jun	21-Jun	22-Jun	24-Jun	25-Jun													* Lost 1/2 day for Drill * Lost 1/2 day for XAGO becoming unhooked during EC Cleanout * Lost 1 day for trouble inerting STSC

Figure 5-2. Schedule Analysis for Sludge Processing (Continued)

STSC Performance Tracking

STSC #	Sludge Source	Working Days (Including OT)																									Issues, Delays, Comments
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
17th STSC Cask 1 405	210 - 146 lbs 260 - 827 lbs 60%	26-Jun	27-Jun	1-Jul	2-Jul	3-Jul	8-Jul	9-Jul	10-Jul	11-Jul	12-Jul	15-Jul	16-Jul	17-Jul	18-Jul												* Lost 4 days for planned maintenance * Lost 1/2 day to troubleshoot truck scale * Lost 1/2 day to troubleshoot Radar Level Gauge
18th STSC Cask 2 403	260 - 964 lbs 240 - 461 lbs 66%	19-Jul	20-Jul	22-Jul	23-Jul	24-Jul	25-Jul	26-Jul	29-Jul	30-Jul	31-Jul	1-Aug	2-Aug	5-Aug													* Lost 1 day to calibrate Oxygen Analyzer * Lost 1/2 day for concern with lid lifting fixture * Lost 1 day to relocate xago from EC-260 to EC-240. * Lost 1/2 day for recovery plan to replace drain port seal.
19th STSC Cask 1 415	230 - 655 lbs 240 - 1581 lbs 92%	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug	12-Aug	13-Aug	14-Aug	15-Aug	19-Aug																* Lost 1/2 day to relocate XAGO from EC-210 to EC-230 * Lost 1/2 day to repeat line flushing to lower dose rates on transfer hose
20th STSC Cask 2 408	230 -169 lbs 240 - 1422 lbs 66%	20-Aug	21-Aug	22-Aug	23-Aug	24-Aug	26-Aug	27-Aug	28-Aug	29-Aug	3-Sep	4-Sep	5-Sep	6-Sep	9-Sep												*Lost 1 day for video inspections of EC-230 *Lost 2 day for video inspection of EC-240 & EC-260 *Lost 1/2 day to repeat line flushing to lower dose rates on transfer hose

Receipt and Hookup
Transfer and Backwash
Disconnect, Inert, Ship
Receipt and Return from Tplant

Corrective Maintenance(CM) during ECRTS
Preventive Maintenance (PM)
Weather Delay
* Dates in Red are Hold Over or Overtime Shifts

Figure 5-2. Schedule Analysis for Sludge Processing (Continued)

5.2 Major Factors Affecting Transfer Optimization

Major factors that affected sludge transfer optimization and ECRTS processing durations included the following:

1. Sludge Density and Settling: During the processing of sludge from Engineered Container SCS-CON-260, settling of material in the STSC performed differently than expected. While transfer rates were good, the settled volume when compared to the design and sampled density created a vessel that was full from a volume perspective, but was only about 60% full based on weight. This issue affected all STSCs that contained sludge from this SCS-CON-260 and led to increased processing times for these STSCs.

2. Radiological Controls: The 105KW Annex was required to be posted as an ARA/High Contamination Area (HCA) or ARA/Contamination Area (CA) during much the processing of the first 10 STSCs. Requirements for an ARA/HCA or ARA/CA were largely driven out of an abundance of caution for worker safety until engineered controls could be demonstrated to be sufficient for control of the hazard. Once engineered controls were proven successful, the posting and associated PPE for work within the Annex was reduced. This provided a major processing efficiency during the processing of the last 10 STSCs.

3. Maintenance: Maintenance, both preventive and non-routine, impacted the ECRTS Process schedule. Annual maintenance both at 100K and T Plant for Cranes, as well as third party maintenance (calibration of the Annex Truck Scale), were contributors to additional delays in the processing schedule. In support of minimizing impact from maintenance, the ECRTS Process was constructed in a modular manner of mechanical process skids, piping, hoses, and control panels and used commercial-off-the-shelf components to the extent practical. A large number of spare components were procured and readied for rapid deployment. These practices limited down time due to minor equipment issues and maximized equipment uptime.

4. Testing: The single greatest factor that affected system optimization was the testing process. Full scale testing of the complete system prior to deployment allowed the team to overcome a number of challenges in a radiologically clean environment at the Hanford 400 Area Maintenance and Storage Facility (MASF). Thorough testing ensured a robust system capable of successfully completing the mission was deployed. Operations personnel utilized the MASF test set-up for operator familiarization, training, and procedure development and optimization.

   During the course of installation and operations, the ECRTS MASF test set-up was utilized to practice repair and maintenance activities, pre-perform and hone multiple recovery plans prior to working in the field, and to develop and test software changes in a non-hazardous/radiological environment prior to field release

5. Weather: Adverse weather conditions during the first quarter of calendar year 2019 led to delays and site closures that negatively impacted processing activities.

5.3 Transportation

Each STSC was shipped from 100K to T Plant under CHPRC-03111, *One-Time Request for Shipment for Sludge Transport from K West Basin to T Plant*. The CHPRC Transportation Safety organization was responsible for ensuring the shipment requirements for the transportation of ECRTS Sludge from the 105KW Annex to T Plant were met. These requirements were incorporated into the 100K operations and maintenance procedures to ensure compliance with the shipping requirements by simply following the specified procedures.

5.4 T Plant

The T Plant STSC Project provided the equipment necessary to receive, store, and maintain radioactive sludge at T Plant where the sludge will be stored until it can be treated to meet disposal site requirements (STP Phase 2).

100K and T Plant used a traveler to track the key interface items between 100K and T Plant. Each traveler was initiated at T Plant when the STSC was selected and loaded into the Cask. The traveler followed the shipment from T Plant to 100K, was filled out during the loading and shipping of the STSC, and returned to T Plant for completion with each shipment. Completed STSC Travelers for each vessel are referenced in Section 6.0 of this document.

5.5 Campaign Completion Criteria

To ensure compliance and consistency with other approval documents, sludge retrieval activities were evaluated and planned against environmental requirements, including those in:

- DOE/RL-2010-63, *Remedial Design/Remedial Action Work Plan for the K Basins Interim Remedial Action: 105-K West Basin Sludge and Knockout Pot Contents Removal*
- HNF-20632, *End Point Criteria or the K Basins Interim Remedial Action*
- DOE/RL-2010-107, *105-K West Basin Qualified Process and Plan to Satisfy Endpoint Criteria (Fuel, Sludge, and Below Water Debris)*

Prior to the start of operations, allowable residual sludge volumes in an EC were defined in HNF-40475, *Functional Design Criteria Sludge Treatment Project Phase 1 – ECRTS*, which required sludge to be removed to the maximum extent practicable and to the extent necessary for the basin demolition waste stream and debris to meet WCH-191, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*. These values were revised by PRC-KC-CN-N-00048, *End-Point Criteria Calculations of Allowable Sludge Residual in Engineered Containers (ECs)*, to allow processing efficiency while evaluating acceptance criteria for waste disposition.

5.6 Campaign Conclusion

Following cleanout of each EC, 100K work teams measured the residual material in the EC using a 100K Work Package, 1E-18-04301, *Engineered Container End Point Criteria Inspection*, to determine if the final EC clean out or end point criteria had been satisfied. The process was performed through visual inspection via long pole cameras and specifically designed EC sludge

depth measurement tooling. Conservative thickness estimates were made of sludge "dusting" on horizontal and sloped surfaces in the ECs.

A summary of allowable residual sludge volumes, as well as final end point inspection volumes, are listed below in Table 5-2, and final inspection excerpts from Work Package 1E-18-04301 are presented in Appendix B for each of the respective ECs.

Table 5-2. Estimated Volumes of Sludge in Engineered Containers

Engineered Container	End Point Criteria from PRC-KC-CN-N-00048	Remaining Sludge Volume from 1E-18-04301
SCS-CON-210	46 gallons	18 gallons
SCS-CON-220	13 gallons	3.5 gallons
SCS-CON-230	3.0 gallons	2.1 gallons
SCS-CON-240	55 gallons	13.9 gallons
SCS-CON-250	55 gallons	34 gallons
SCS-CON-260	55 gallons	37.8 gallons

Sludge has been removed from all ECs to a level that exceeds the final acceptable end point criteria established by K-Basin Closure Group.

6.0 References

CHPRC-03111, *One-Time Request for Shipment for Sludge Transport from K West Basin to T Plant*, Revision 3, CH2M HILL Plateau Remediation Company Richland, Washington, June, 2019.

CHPRC-1301317, Interoffice Memorandum, *Determination of Sludge Volume in the KW Basin Containers SCS-CON-210, SCS-CON-220, SCS-CON-230, SCS-CON-240, SCS-CON-250, and SCS-CON-260 for the 2012 Biennial Sludge Inventory*, M.T. Bachand, D.D. Craig and J.F. Thompson, Jr., April, 2013.

DOE/RL-2010-107, *105-K West Basin Qualified Process and Plan to Satisfy Endpoint Criteria (Fuel, Sludge, and Below Water Debris)*, Revision 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington, January, 2011.

DOE/RL-2010-63, *Remedial Design/Remedial Action Work Plan for the K Basins Interim Remedial Action: 105-K West Basin Sludge and Knockout Pot Contents Removal*, Revision 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington, April, 2016.

HNF-20632, *End Point Criteria or the K Basins Interim Remedial Action*, Revision 3, CH2M HILL Plateau Remediation Company, Richland, Washington, August, 2010.

HNF-34695, *Sludge Treatment Project Mission Need Statement – Project A-21C*, Revision 5, CH2M HILL Plateau Remediation Company, Richland, Washington, March, 2009.

HNF-40475, *Functional Design Criteria Sludge Treatment Project Phase 1 – ECRTS,* Revision 7, CH2M HILL Plateau Remediation Company, Richland, Washington, September, 2016.

HNF-SD-SNF-TI-015, *Spent Nuclear Fuel Project Technical Databook*, Volume 2, Sludge, Revision 28, CH2M HILL Plateau Remediation Company, Richland, Washington, August, 2018.

KBC-30811, *Sludge Treatment Project – Project Execution Plan*, Revision 8, CH2M HILL Plateau Remediation Company, Richland, Washington, December, 2018.

PRC-KC-CN-N-00048, *End-Point Criteria Calculations of Allowable Sludge Residual in Engineered Containers (ECs)*, Revision 0, CH2M HILL Plateau Remediation Company, Richland, Washington, September, 2019.

PRC-STP-00358, *Operating Sequence and Interlock Definition Document for the Sludge Treatment Project Engineered Container Retrieval and Transfer System*, Revision 9, CH2M HILL Plateau Remediation Company, Richland, Washington, December, 2017.

PRC-STP-01080, *Sludge Treatment Project-Engineered Container Retrieval and Transfer System - STSC Traveler Data Form for SCS-CON-220 in ECRT-CON-W-401*, Revision 0, CH2M Hill Plateau Remediation Company, Richland, WA, July, 2019.

PRC-STP-01081, *Sludge Treatment Project-Engineered Container Retrieval and Transfer System - STSC Traveler Data Form for SCS-CON-230 Layered with SCS-CON-250 in ECRT-CON-W-402*, Revision 0, CH2M Hill Plateau Remediation Company, Richland, WA, April, 2019.

PRC-STP-01082, *Sludge Treatment Project - Engineered Container Retrieval and Transfer System - STSC Traveler Data Form for SCS-CON-260 and SCS-CON-240 in ECRT-CON-W-403*, Revision 0, CH2M Hill Plateau Remediation Company, Richland, WA, August, 2019.

PRC-STP-01083, *Sludge Treatment Project-Engineered Container Retrieval and Transfer System - STSC Traveler Data Form for SCS-CON-230 Layered with SCS-CON-250 with ECRT-CON-W-404*, Revision 0, CH2M Hill Plateau Remediation Company, Richland, WA, February, 2019.

PRC-STP-01084, *Sludge Treatment Project - Engineered Container Retrieval and Transfer System - STSC Traveler Data Form for SCS-CON-210 with High Dose Material Layered with SCS-CON-260 in ECRT-CON-W-405*, Revision 0, CH2M Hill Plateau Remediation Company, Richland, WA, August, 2019.

PRC-STP-01085, *Sludge Treatment Project-Engineered Container Retrieval and Transfer System - STSC Traveler Data Form for SCS-CON-230 Layered with SCS-CON-250 in ECRT-CON-W-406*, Revision 0, CH2M Hill Plateau Remediation Company, Richland, WA, May, 2019.

PRC-STP-01087, *Sludge Treatment Project-Engineered Container Retrieval and Transfer System - STSC Traveler Data Form for SCS-CON-230 Layered with SCS-CON-240 in ECRT-CON-W-408*, Revision 0, CH2M Hill Plateau Remediation Company, Richland, WA, September, 2019.

PRC-STP-01089, *Sludge Treatment Project-Engineered Container Retrieval and Transfer System - STSC Traveler Data Form for SCS-CON-230 Layered with SCS-CON-250 and SCS-CON-260 in ECRT-CON-W-410*, Revision 0, CH2M Hill Plateau Remediation Company, Richland, WA, May, 2019.

PRC-STP-01090, *Sludge Treatment Project-Engineered Container Retrieval and Transfer System - STSC Traveler Data Form for SCS-CON-230 Layered with SCS-CON-250 with ECRT-CON-W-411*, CH2M Hill Plateau Remediation Company, Richland, WA, February, 2019.

PRC-STP-01091, *Sludge Treatment Project-Engineered Container Retrieval and Transfer System - STSC Traveler Data Form for SCS-CON-230 Layered with SCS-CON-250 in ECRT-CON-W-412*, Revision 0, CH2M Hill Plateau Remediation Company, Richland, WA, February, 2019.

PRC-STP-01092, *Sludge Treatment Project-Engineered Container Retrieval and Transfer System - STSC Traveler Data Form for SCS-CON-230 Layered with SCS-CON-250 with ECRT-CON-W-413*, Revision 0, CH2M Hill Plateau Remediation Company, Richland, WA, February, 2019.

PRC-STP-01094, *Sludge Treatment Project-Engineered Container Retrieval and Transfer System - STSC Traveler Data Form for SCS-CON-230 Layered with SCS-CON-240 in ECRT-CON-W-415*, Revision 0, CH2M Hill Plateau Remediation Company, Richland, WA, August, 2019.

PRC-STP-01095, *Sludge Treatment Project-Engineered Container Retrieval and Transfer System - STSC Traveler Data Form for SCS-CON-220 Layered with SCS-CON-260 in ECRT-CON-W-416*, Revision 0, CH2M Hill Plateau Remediation Company, Richland, WA, July, 2019.

PRC-STP-01097, *Sludge Treatment Project-Engineered Container Retrieval and Transfer System - STSC Traveler Data Form for SCS-CON-210 in ECRT-CON-W-418,* Revision 0, CH2M Hill Plateau Remediation Company, Richland, WA, September, 2018.

PRC-STP-01098, *Sludge Treatment Project-Engineered Container Retrieval and Transfer System - STSC Traveler Data Form for SCS-CON-230 Layered with SCS-CON-260 in ECRT-CON-W-419*, Revision 0, CH2M Hill Plateau Remediation Company, Richland, WA, July, 2019.

PRC-STP-01099, *Sludge Treatment Project - Engineered Container Retrieval and Transfer System - STSC Traveler Data Form for SCS-CON-210 with High Dose Material in ECRT-CON-W-420*, Revision 0, CH2M Hill Plateau Remediation Company, Richland, WA, November, 2018.

PRC-STP-01100, *Sludge Treatment Project-Engineered Container Retrieval and Transfer System - STSC Traveler Data Form for SCS-CON-210 with High Dose Material in ECRT-CON-W-421*, Revision 0, CH2M Hill Plateau Remediation Company, Richland, WA, November, 2018.

PRC-STP-01101, *Sludge Treatment Project-Engineered Container Retrieval and Transfer System - STSC Traveler Data Form for SCS-CON-230 Layered with SCS-CON-260 in ECRT-CON-W-422*, Revision 0, CH2M Hill Plateau Remediation Company, Richland, WA, May, 2019.

PRC-STP-01102, *Sludge Treatment Project-Engineered Container Retrieval and Transfer System - STSC Traveler Data Form for SCS-CON-260 in ECRT-CON-W-423*, Revision 0, CH2M Hill Plateau Remediation Company, Richland, WA, June, 2019

PRC-STP-01103, *Sludge Treatment Project Engineered Container Retrieval and Transfer System STSC Traveler Data Form for SCS-CON-210 with High Dose Material in ECRT-CON-W-424*, Revision 0, CH2M Hill Plateau Remediation Company, Richland, WA, September, 2018.

WCH-191, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*, Revision 4, Washington Closure Hanford, Richland, Washington, 2015.

Work Package 1E-18-04301, WCN #2, *Engineered Container End Point Criteria Inspection*, CH2M Hill Plateau Remediation Company, Richland, WA, June, 2019

Appendix A

Graphical Representation of EC Retrieval Campaigns

SCS-CON-210

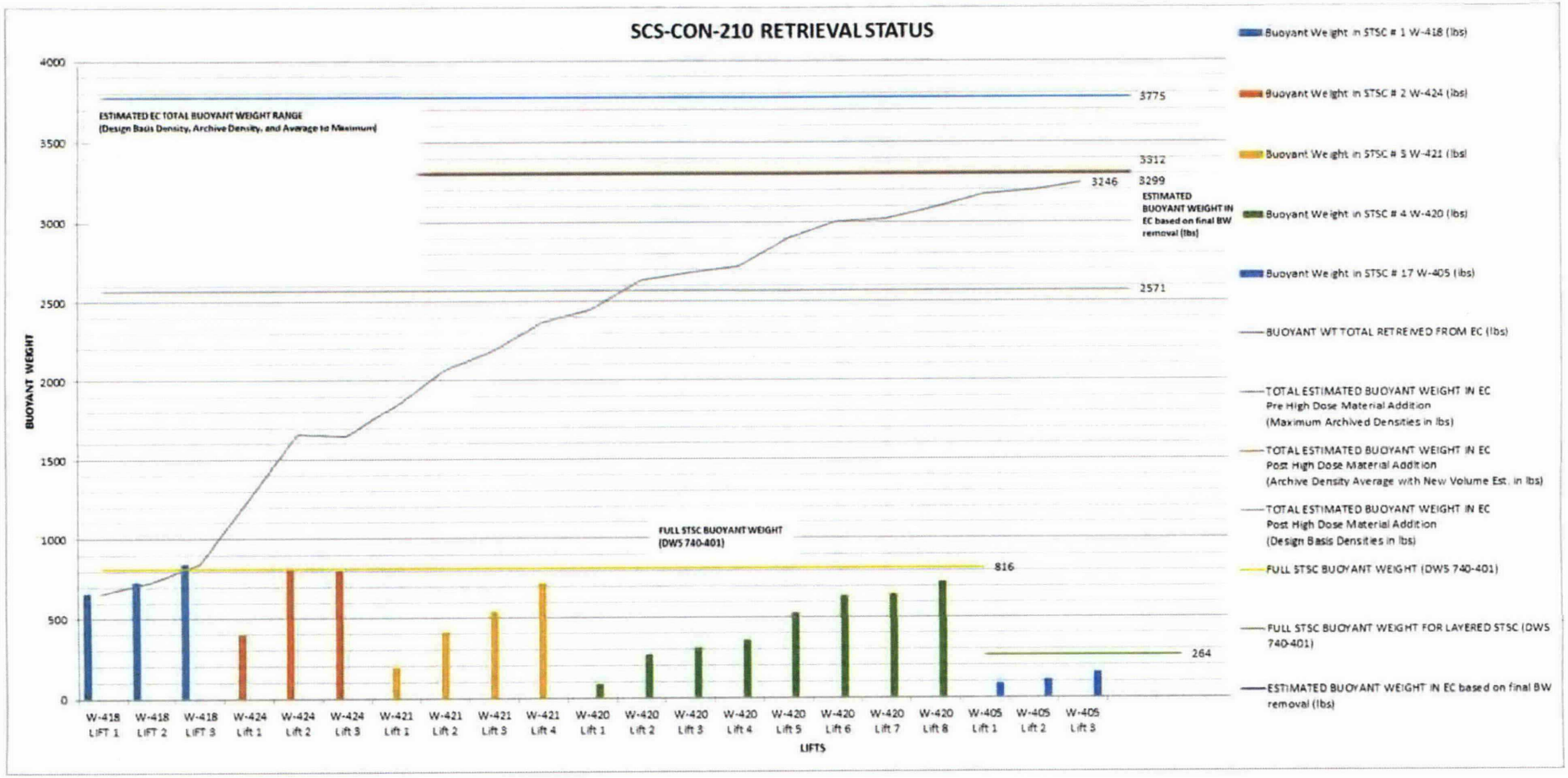


Figure A-1. EC SCS-CON-210 Retrieval Efficiency for 21 lifts in 5 STSCs = 98.4%

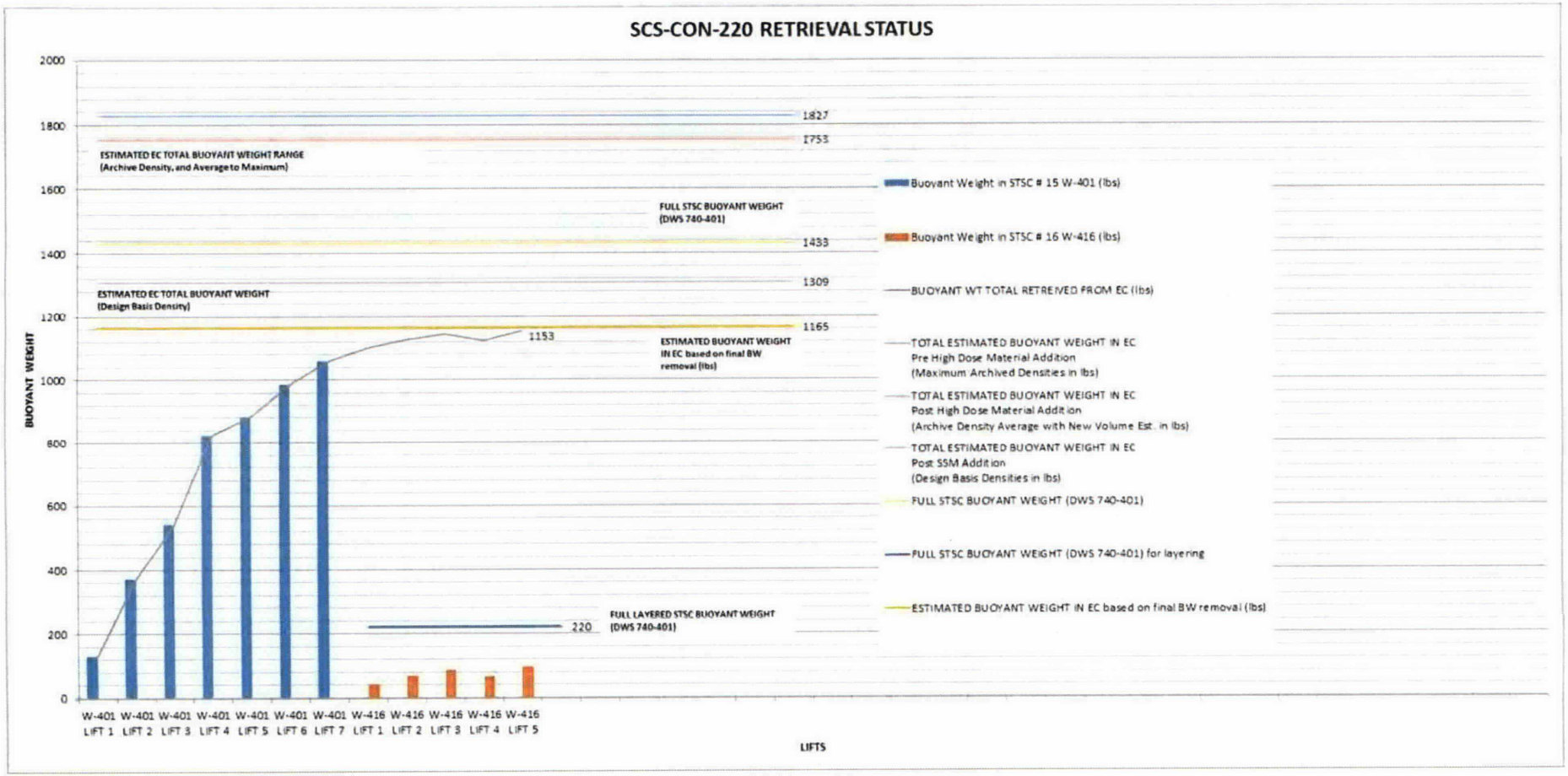


Figure A-2. EC SCS-CON-220 Retrieval Efficiency for 12 lifts in 2 STSCs = 99.0%

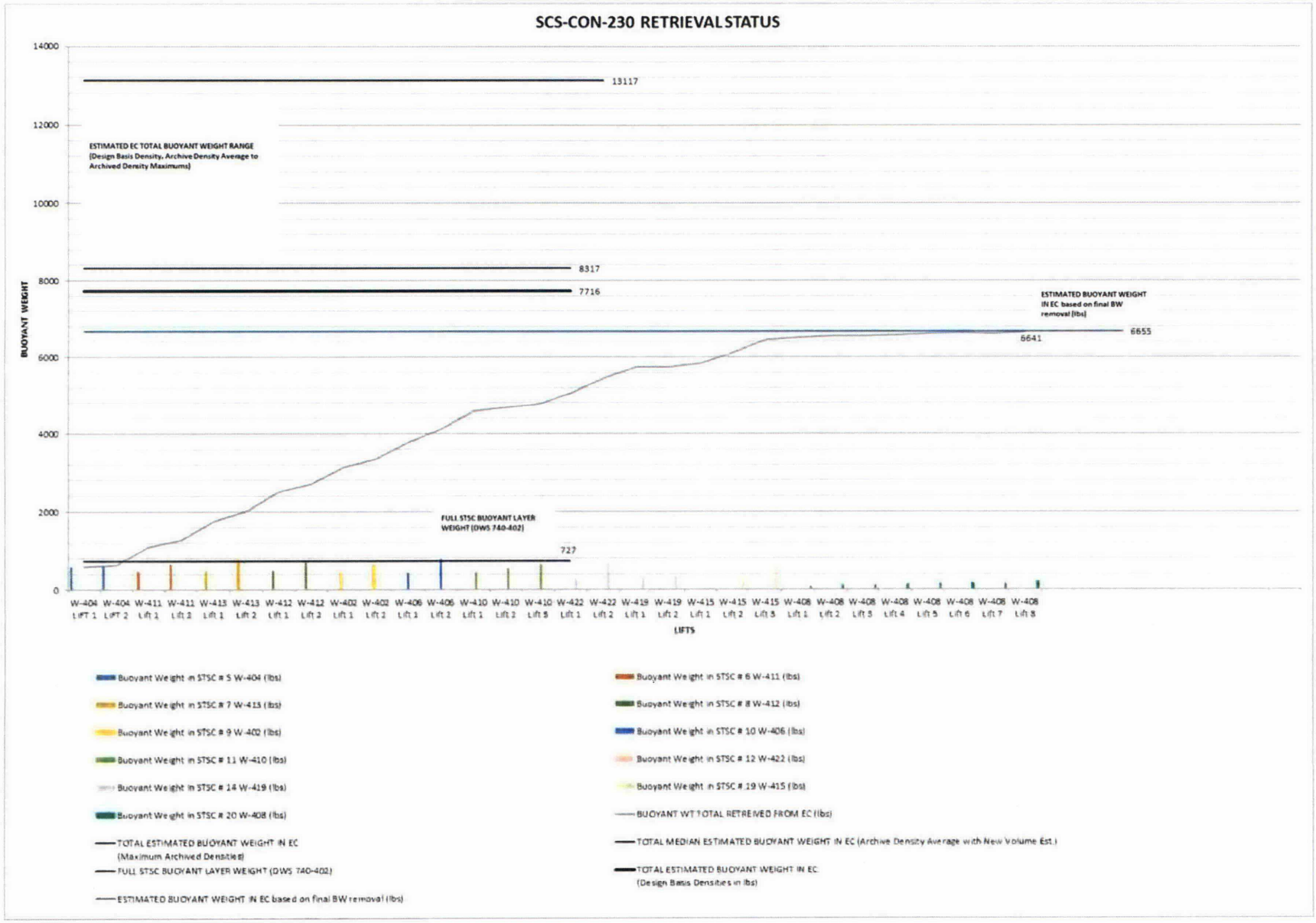


Figure A-3. EC SCS-CON-230 Retrieval Efficiency for 30 lifts in 11 STSCs = 99.8%

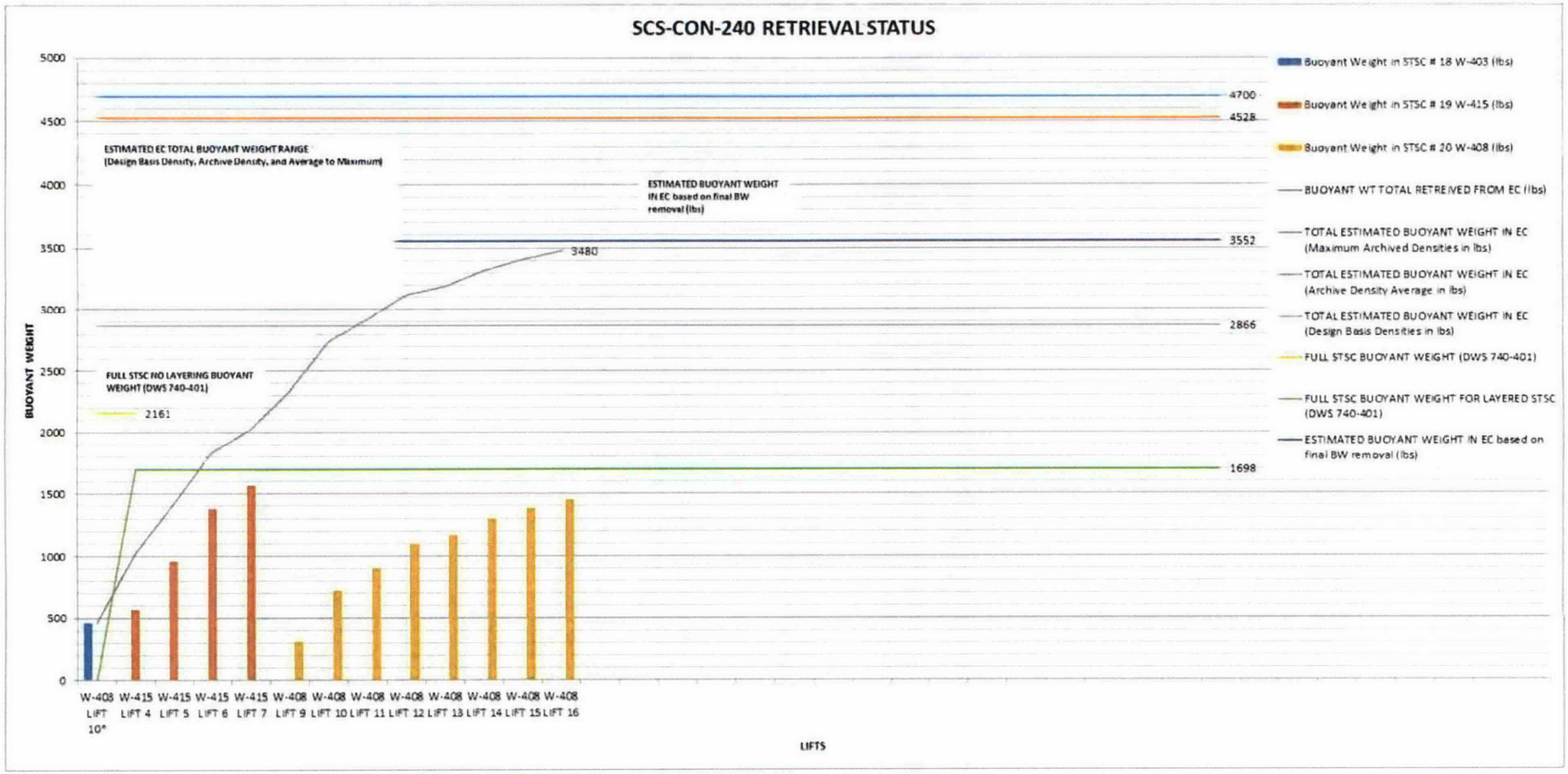


Figure A-4. EC SCS-CON-240 Retrieval Efficiency for 13 lifts in 3 STSCs = 98.0%

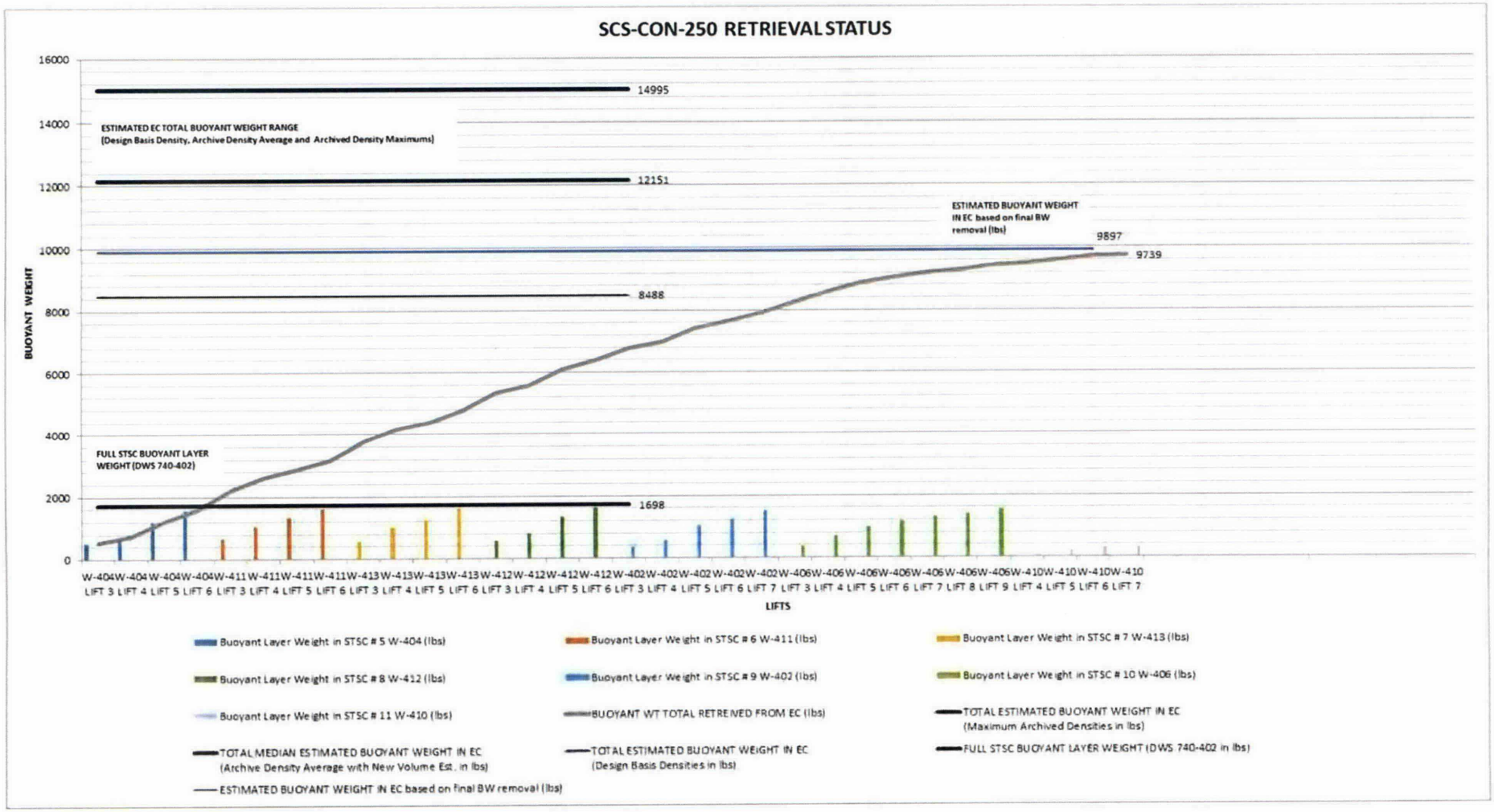


Figure A-5. EC SCS-CON-250 Retrieval Efficiency for 32 lifts in 7 STSCs = 98.4%

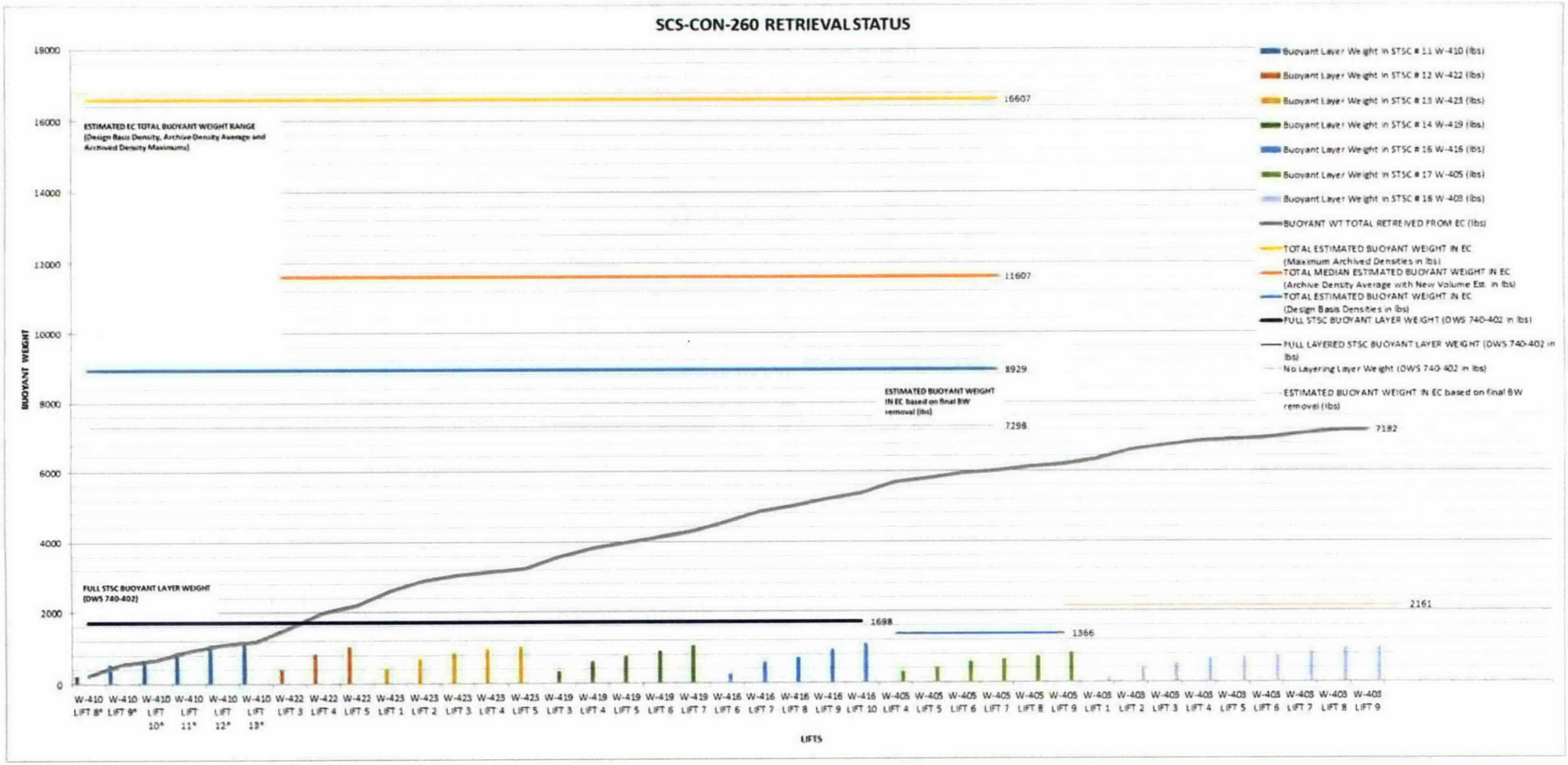


Figure A-6. EC SCS-CON-260 Retrieval Efficiency for 39 lifts in 7 STSCs = 98.4%

Appendix B
End Point Evaluation Results

CHPRC WORK RECORD

1. Document Number: IE-18-04301 / Y

2. Work Item Title: Engineered Container End Point Criteria Inspection

FB	Date	PR#	Turnover, Problem Description, Action Taken	Name (Print/Sign)	RES	HRS
	9/4/19	–	Completed Inspections & measurements			
			of CON-240. Data collected			
			and value calculated to be			
	9/5/19		13.9 gallons.	Gabriel Mosbrucker 9/4/19		
			Reviewed package. Work activity will			
			take place at CON-260. Concur with release. Tarik Dills			
	9/5/19	–	Performed inspection of			
			CON-260 – data collected			
			and final value calculated			
			to be 37.8 gallons.	Gabriel Mosbrucker 9/5/19		
	9/5/19		The following remaining			
			sludge volumes are acceptable			
			to the 100K Closure organization:			
			SCS-CON-210, 18 gallons; SCS-CON-220, 4 gallons;			
			SCS-CON-230, ~~2.1~~ 2.2 as of 9-5-19 gallons; SCS-CON-240, 14 gallons;			
			SCS-CON-250, 34 gallons; SCS-CON-260, 38 gallons.			
			9/5/19 100K WSKPKG to TRANS.	D. Crane 9/5/19		
	9/5/19		The ≤ 8 gallons mentioned in Table 1 (WCN-1)			
			for CON-250 was based on old criteria that is			
			being changed	9/5/19		

NOTE: Entries may be written across all columns to the right of Date, but each entry should be signed.

FB – √ or X if entry contains feedback to be captured
PR – Partial Release Number associated with this entry (Optional)
RES – Craft or Resource Code (optional)
HRS – Actual hours (optional)

A-6005-119 (REV 5)

SCS-CON-210 End Point Results

RECORD COPY

1E-18-04301/Y

Engineered Container End Point Criteria Inspection

WCN-2

Table 1. EC End Point Criteria Data

SCS-CON-210	Bin 1	Bin 2	Bin 3	Bin 4	Bin 5	Bin 6	Bin 7	Bin 8	Total
Sludge Depth (in)	7	7	13.25	6.75	7.5	7.5	6.25	7.75	From spreadsheet. Attached
	7	7	13.54	7	8	8	7	8	Rounded to match Fig. 1
Estimated Volume (gal)	1.19	1.19	8	1.19	1.74	1.74	1.19	1.74	17.98 Based on rounded depth
OPS (initials/date)	7/22/19	7/22/19	7/22/19	7/22/19	7/22/19	7/22/19	7/22/19	7/22/19	
QA (initials/date)	RJK 7/22/19	RJK 7/22/19	RJK 7/22/19	RJK 7/22/19	RJK 7/22/19	RJK 7/22/19	RJK 7/22/19	RJK 7/22/19	
PCE (initials/date)	EP/7/22/19	EP/7/22/19	EP/7/22/19	EP/7/22/19	EP/7/22/19	EP 7/22/19	EP 7/22/19	EP/7/22/19	
DA						Total Volume remaining in EC is less than or equal to 18 gallons			Sign/Date 7/22/19
K Basin Closure Rep						Total Volume remaining in EC is less than or equal to 18 gallons			Sign/Date 7/23/19
SOM/FM						Total Volume remaining in EC is less than or equal to 18 gallons			Sign/Date 7/23/19

EC 210 End Point	BIN 1	BIN 2	BIN 3	BIN 4	BIN 5	BIN 6*	BIN 7	BIN 8*		Notes
Bottom ruler reading (bottom is 0)	5.75	4.75	10.75	4.5	5.75	6.25	5	5		
Bottom ruler length	24	24	24	24	24	24	24	24		
Top ruler reading (top is 0)	5.5	6.5	6.75	6.5	6	5.5	5.5	7		
Top ruler length	24	24	24	24	24	24	24	24		
EC depth to sludge	80.75	80.75	74.5	81	80.25	80.25	81.5	80		Based on length of measuring tool 92". See formula below.
EC depth	87.75	87.75	87.75	87.75	87.75	87.75	87.75	87.75		
Sludge depth (in)	7	7	13.25	6.75	7.5	7.5	6.25	7.75		
Depth rounded (in)	7	7	13.54	7	8	8	7	8		Rounded up where needed to match Figure 1 of 1E-18-4301.
Sludge volume (gal)	1.19	1.19	7.55	1.09	1.47	1.47	0.88	1.6	16.44	Figure 1 of 1E-18-4301 interpolated.
Conservative sludge volume	1.19	1.19	8	1.19	1.74	1.74	1.19	1.74	17.98	Based on Rounded sludge depths.

EC depth to sludge formula: Bottom ruler length (24") minus bottom ruler reading + Top ruler length (24") minus top ruler reading + Distance between rulers (44").

EC Depth of 87.75" derived from drawing H-1-88419, KW SRSS/SCS Sludge Container Assembly.

Sludge Depth = EC Depth minus EC depth to sludge.

Don Craig 7-22-19

Explanation of Engineer Container (EC) End Point spreadsheet found in 1E-18-04301/Y.

The ruler used in ECs is 92 inches long from under the plate to the end. It has a 24 inch ruler at the top starting under the plate (top is 0 inches). The bottom ruler is also 24 inches and starts at 0 inches at the bottom. In between the two rulers is a gap of 44 inches.

The equations used on the spreadsheet are:

EC depth to sludge = (bottom ruler length – Bottom ruler reading) + Length between rulers [44 inches] + (Top ruler length – Top ruler reading)

Sludge depth (in) = EC depth – EC depth to sludge

The sludge volume (gal) is read or interpolated from Figure 1 in 1E-18-04301/Y.

The sludge depth and conservative sludge depth are both entered on Table 1.

Estimated Volume (gal) on Table 1 uses the conservative volume. Sometimes an additional adjustment is added for miscellaneous other sludge holdup.

Don Craig

DA ECRTS Retrieval System

8-28-19

Craig, Donald D (Don)

From:	Mosbrucker, Gabriel R
Sent:	Monday, July 22, 2019 12:15 PM
To:	Craig, Donald D (Don); Mccracken, Kurt J
Cc:	Penland, Eric V; Kidder, Ronald J; Evans, Ketra M; St Germaine, James M; Garza, Michael A
Subject:	RE: CON-210 End Point Results

Don,

The below changes look good to me. Thanks

Gabriel Mosbrucker
Office: (509) 376-6718
Cell: (509) 250-2625

From: Craig, Donald D (Don) <donald_d_don_craig@rl.gov>
Sent: Monday, July 22, 2019 11:40 AM
To: Mosbrucker, Gabriel R <gabriel_r_mosbrucker@rl.gov>; Mccracken, Kurt J <kurt_j_mccracken@rl.gov>
Cc: Penland, Eric V <eric_v_penland@rl.gov>; Kidder, Ronald J <ronald_j_kidder@rl.gov>; Evans, Ketra M <ketra_m_evans@rl.gov>; St Germaine, James M <james_m_st_germaine@rl.gov>; Garza, Michael A <michael_a_garza@rl.gov>
Subject: RE: CON-210 End Point Results

Gabe and Ron,

After review of the photos, I adjusted some of your numbers below.

If they look ok, I will fill out the table in the work package and get your initials.

Don

From: Mosbrucker, Gabriel R <gabriel_r_mosbrucker@rl.gov>
Sent: Saturday, July 20, 2019 11:40 AM
To: Craig, Donald D (Don) <donald_d_don_craig@rl.gov>; Mccracken, Kurt J <kurt_j_mccracken@rl.gov>
Cc: Penland, Eric V <eric_v_penland@rl.gov>; Kidder, Ronald J <ronald_j_kidder@rl.gov>; Evans, Ketra M <ketra_m_evans@rl.gov>; St Germaine, James M <james_m_st_germaine@rl.gov>; Garza, Michael A <michael_a_garza@rl.gov>
Subject: CON-210 End Point Results

Results:

We had a camera issue in Bin 1 (which is where we started). Needless to say, we stirred it up pretty bad then decided it would be better to bring the camera over from 220. We probably need to get another picture from Bin 1 since you can hardly make out the 6". Also, the video recorder was acting weird so we could only take pictures of the monitor. The results are below and the pictures are HERE. Let me know what you think. Also, we took some pre-spatch pics of CON-260 (not great), but they are located HERE. I will get better overview pics of both containers the next time we go in.

Bin 1: **Sludge: 5.75"**
Top: 5.50"

Bin 2: **Sludge: 4.75"**
Top: 6.50"

Bin 3: **Sludge: 10.75"**
Top: ~~7.00"~~ 6.75"

Bin 4: **Sludge: 4.50"**
Top: ~~6.00"~~ 6.50"

Bin 5: **Sludge: ~~6.00"~~** 5.75"
Top: ~~6.50"~~ 6.00"

Bin 6: **Sludge: ~~6.50"~~** 6.25"
Top: 5.50"

Bin 7: **Sludge: 5.00"**
Top: 5.50"

Bin 8: **Sludge: 5.00"**
Top: 7.00"

Gabriel Mosbrucker
Office: (509) 376-6718
Cell: (509) 250-2625

SCS-CON-210 End Point Inspection Highlights (07.19.19)

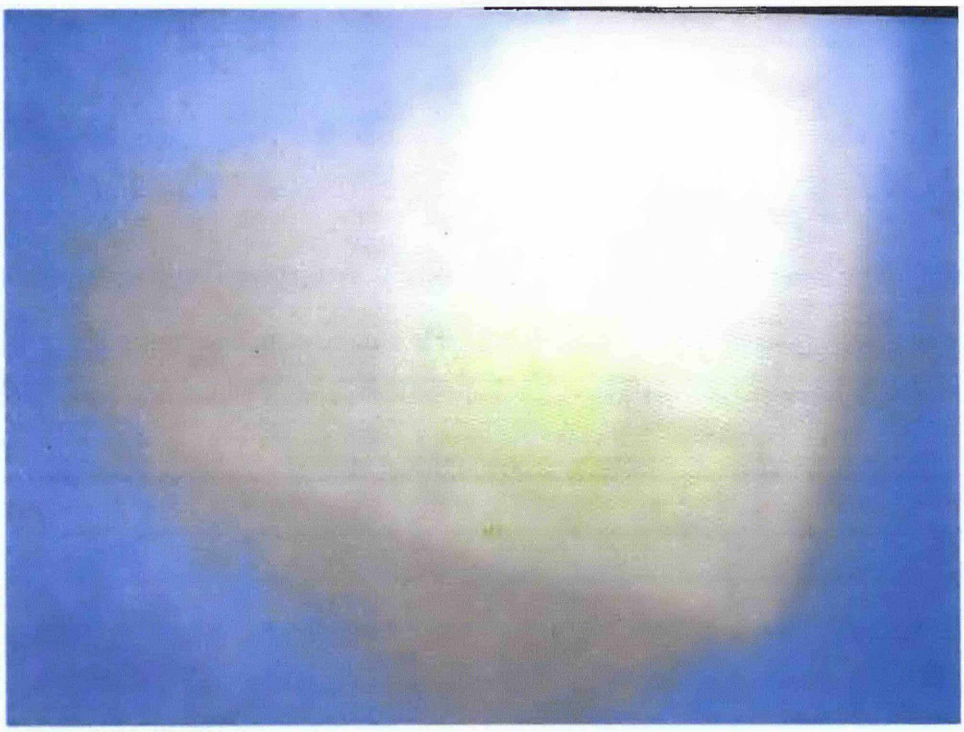


Figure 1: Bin 1 Bottom Sludge Measurement (5 ¾")

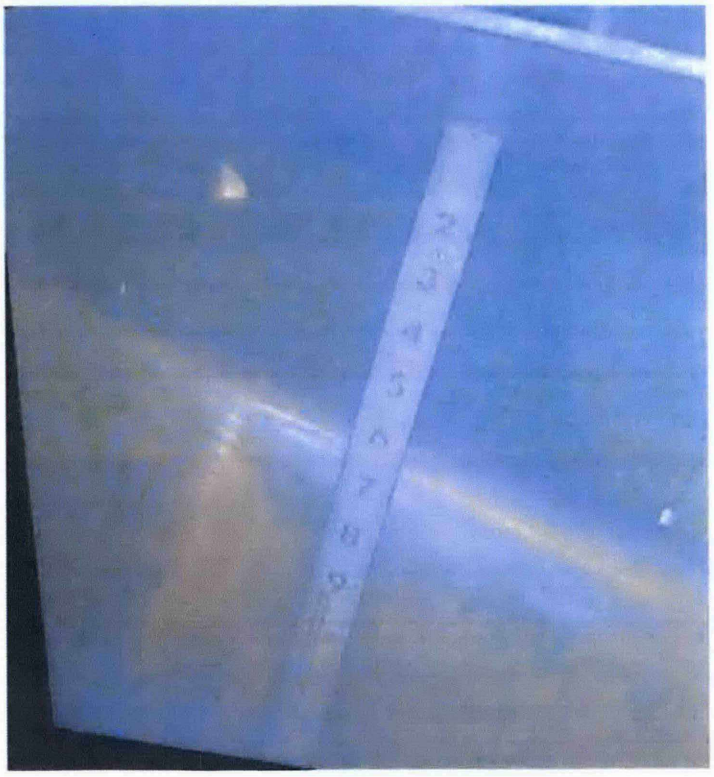


Figure 2: Bin 1 Top Flange Measurement

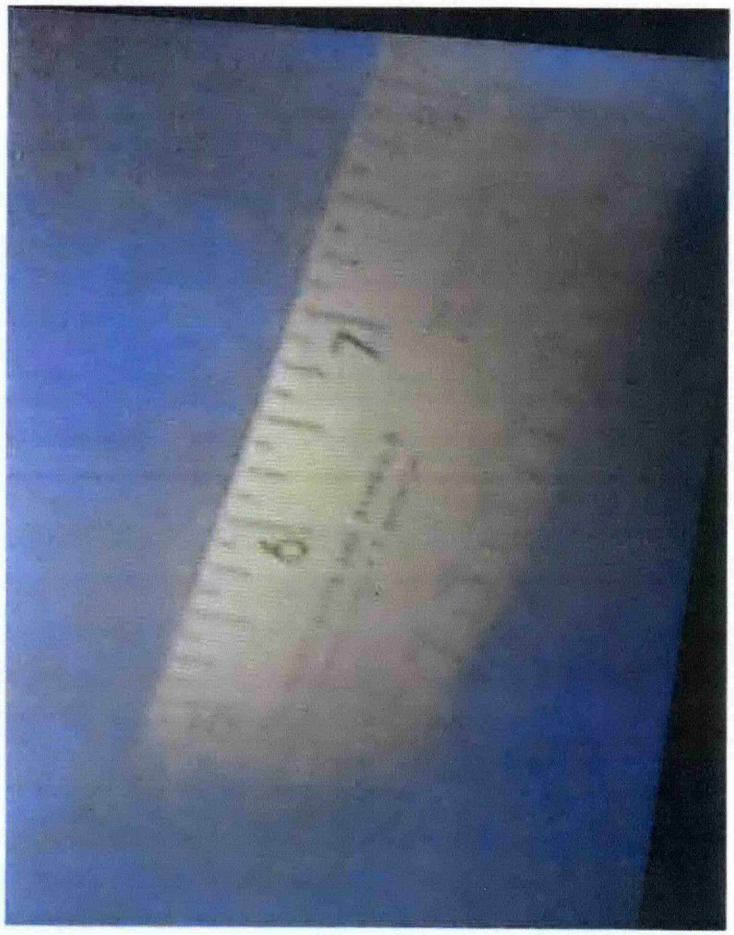


Figure 3: Bin 2 Bottom Sludge Measurement

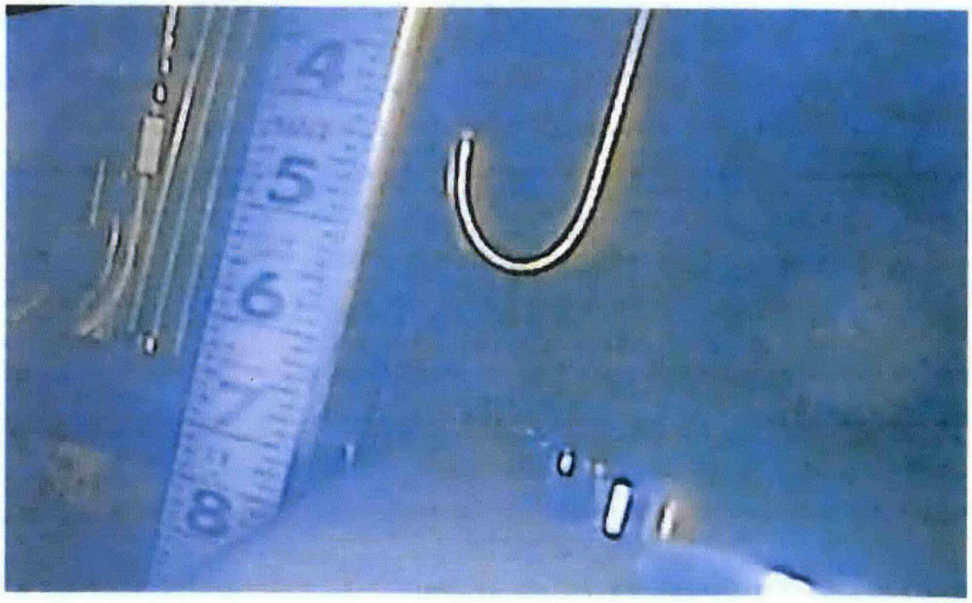


Figure 4: Bin 2 Top Flange Measurement

SCS-CON-210 End Point Inspection Highlights (07.19.19)

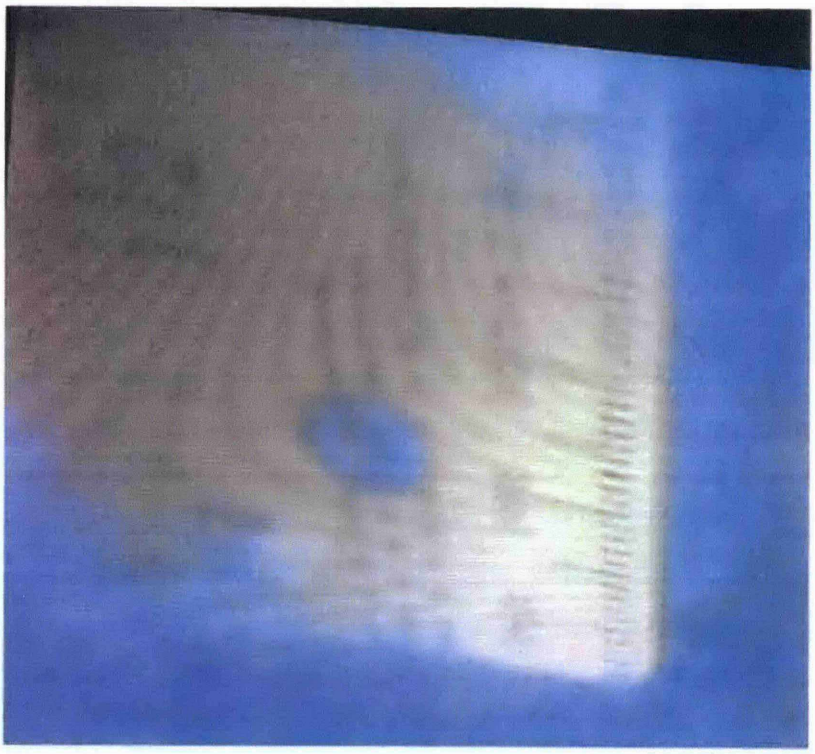


Figure 5: Bin 3 Bottom Sludge Measurement

Figure 6: Bin 3 Top Flange Measurement

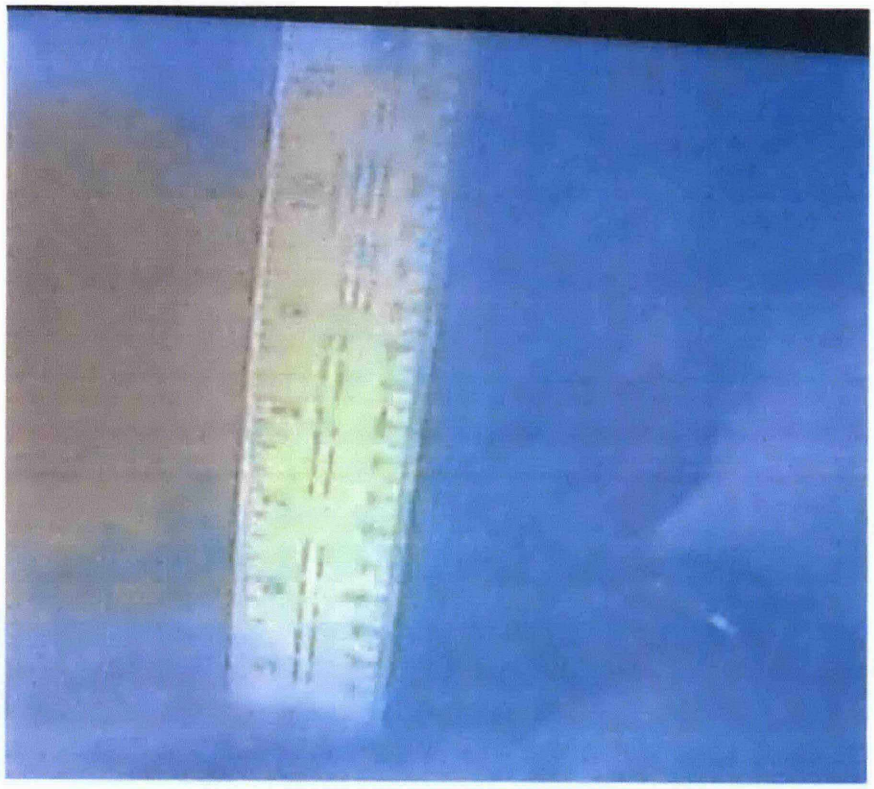


Figure 7: Bin 4 Bottom Sludge Measurement

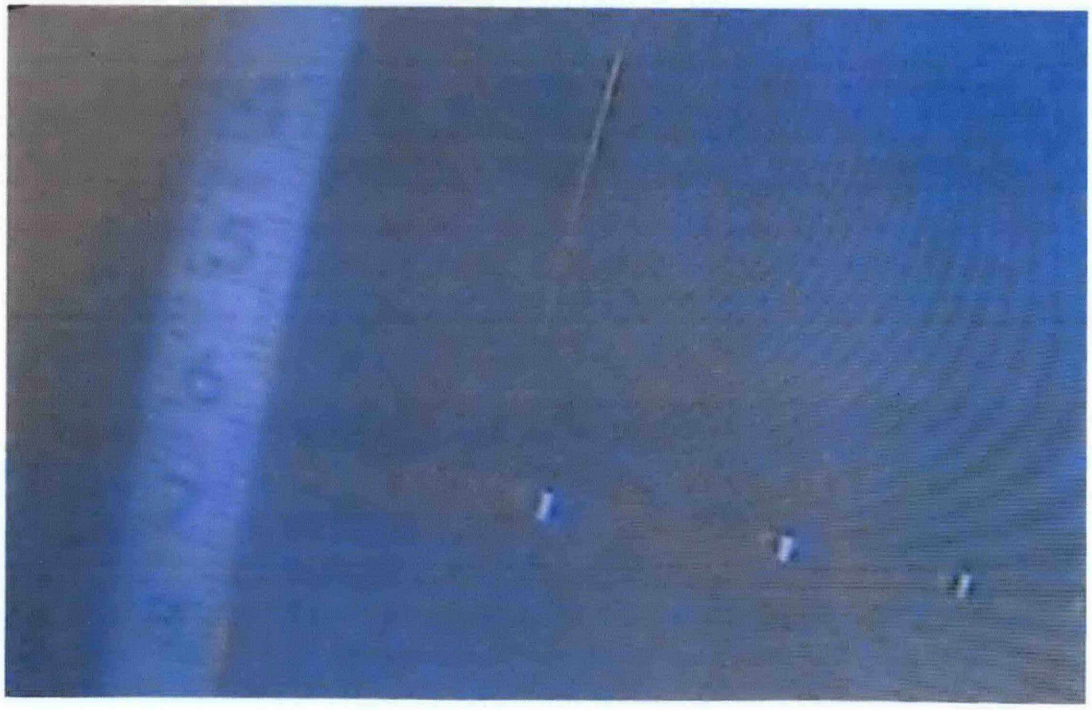


Figure 8: Bin 4 Top Flange Measurement

Figure 9: Bin 5 Bottom Sludge Measurement

Figure 10: Bin 5 Top Flange Measurement

Figure 11: Bin 6 Bottom Sludge Measurement

Figure 12: Bin 6 Top Flange Measurement

Figure 13: Bin 7 Bottom Sludge Measurement

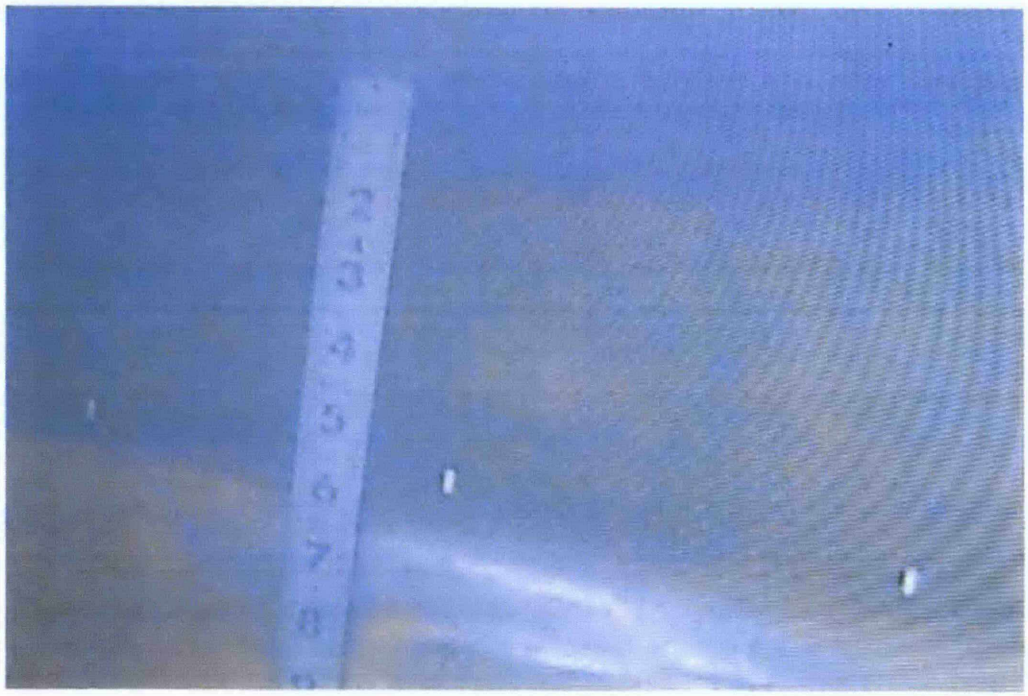


Figure 14: Bin 7 Top Flange Measurement

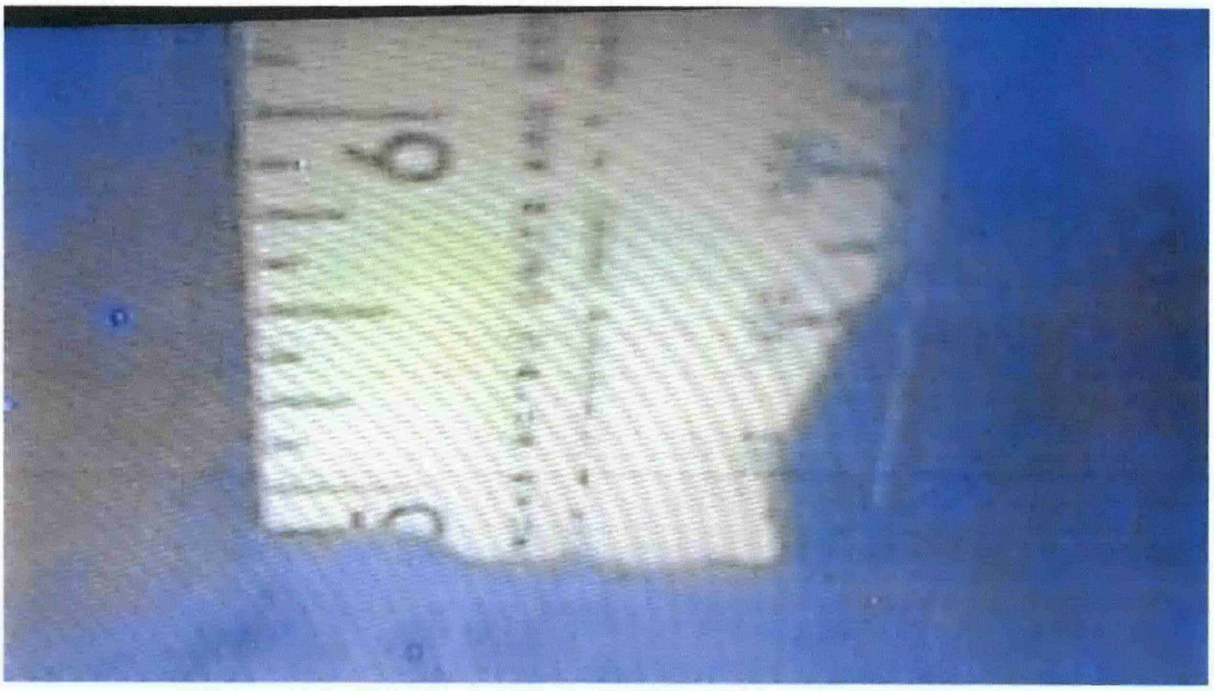


Figure 15: Bin 8 Bottom Sludge Measurement

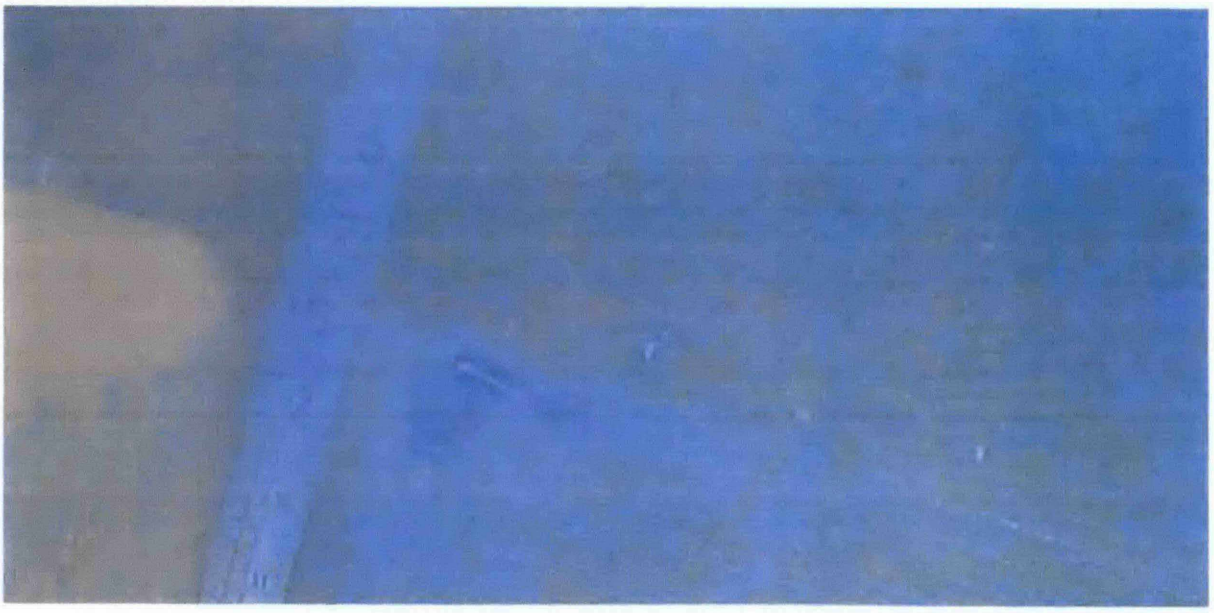


Figure 16: Bin 8 Top Flange Measurement

SCS-CON-220 End Point Results

Engineered Container End Point Criteria Inspection

WCN-2

Table 1. EC End Point Criteria Data

SCS-CON-220	Bin 1	Bin 2	Bin 3	Bin 4	Bin 5	Bin 6	Bin 7	Bin 8	Total
Sludge Depth (in)	3.75	4.25	3.75	3.75	3.75	2.25	3	4.75	ACTUAL
	4.75	5.25	4.75	4.75	4.75	3.25	4	5.75	ADDED 1" FOR CONSERVATISM
Estimated Volume (gal)	0.43	0.55	0.43	0.43	0.43	0.19	0.28	0.71	3.45 gal BASED ON CONSERVATIVE #'s
OPS (initials/date)	[illegible] 6/25/19	[illegible] 6/25/19	[illegible] 6/25/19	[illegible] 6/25/19	[illegible] 6/25/19	[illegible] 6/25/19	[illegible] 6/25/19	[illegible] 6/25/19	
QA (initials/date)	6/25/19 RJK	6/25/19 RJK	6/25/19 RJK	6/25/19 RJK	6/25/19 RJK	6/25/19 RJK	6/25/19 RJK	6/25/19 RJK	
PCE (initials/date)	6/25/19 [illegible]	[illegible] 6/25/19	[illegible] 6/25/19	[illegible] 6/25/19	[illegible] 6/25/19	[illegible] 6/25/19	[illegible] 6/25/19	[illegible] 6/25/19	
DA						Total Volume remaining in EC is less than or equal to 4 gallons			Sign/Date [illegible] 6/25/19
K Basin Closure Rep						Total Volume remaining in EC is less than or equal to 4 gallons			Sign/Date [illegible] 6/25/19
SOM/FM						Total Volume remaining in EC is less than or equal to 4 gallons			Sign/Date [illegible] 6/25/19

CON 220
6/25/19

END POINT

	4	3	2	1
	1	5	3	1
BOTTOM # SWEEP	$1\frac{3}{4}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$
TOP #	$5\frac{1}{2}$	$5\frac{1}{2}$	$5\frac{1}{2}$	$5\frac{1}{2}$
BOTTOM #	$2\frac{3}{4}$ - 3	1	2 - 3	3
TOP #	6	$5\frac{1}{2}$	$5\frac{1}{2}$	$5\frac{1}{2}$
	8	6	4	2
	5	6	7	8

UP TO 1st SPEAR

2"-4" ~ 6 in³

HIKE 1" 6" LONG

1" WIDE ~ 6 in³

SET TOP OF BOTTOM PIPE

08/25/2019 09:41 FAX 001/002

EC 220 End Point	BIN 1	BIN 2	BIN 3	BIN 4	BIN 5	BIN 6*	BIN 7	BIN 8*		Notes
bottom ruler reading (bottom is 0)	2.5	3	2.5	2.5	2.5	1	1.75	3		see top of bottom pipe in bin 6. minor sludgeon wall/corner of bin 2, between 1 and 3, between 3 and 5
bottom ruler length	24	24	24	24	24	24	24	24		
top ruler reading (top is 0)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	6		
top ruler length	24	24	24	24	24	24	24	24		
EC depth to sludge	84	83.5	84	84	84	85.5	84.75	83		Length and cal of measureing tool
EC depth	87.75	87.75	87.75	87.75	87.75	87.75	87.75	87.75		
sludge depth (in)	3.75	4.25	3.75	3.75	3.75	2.25	3	4.75		
						10		4		
sludge volume (gal)	0.25	0.33	0.25	0.25	0.25	0.1	0.16	0.43	2.02	
add inch for conservatism	4.75	5.25	4.75	4.75	4.75	3.25	4	5.75		
conservative sludge volume	0.43	0.55	0.43	0.43	0.43	0.19	0.28	0.71	3.45	

4.25

DOM 9/5/19

Explanation of Engineer Container (EC) End Point spreadsheet found in 1E-18-04301/Y.

The ruler used in ECs is 92 inches long from under the plate to the end. It has a 24 inch ruler at the top starting under the plate (top is 0 inches). The bottom ruler is also 24 inches and starts at 0 inches at the bottom. In between the two rulers is a gap of 44 inches.

The equations used on the spreadsheet are:

EC depth to sludge = (bottom ruler length – Bottom ruler reading) + Length between rulers [44 inches] + (Top ruler length – Top ruler reading)

Sludge depth (in) = EC depth – EC depth to sludge

The sludge volume (gal) is read or interpolated from Figure 1 in 1E-18-04301/Y.

The sludge depth and conservative sludge depth are both entered on Table 1.

Estimated Volume (gal) on Table 1 uses the conservative volume. Sometimes an additional adjustment is added for miscellaneous other sludge holdup.

Don Craig

DA ECRTS Retrieval System

8-28-19

Figure 1 Bin1/Bin 3 Ridge Sludge Remaining

Figure 2 Bin 1 Sludge Depth

Figure 3 Bin 3/Bin 1 Ridge Sludge

Figure 4 Bin 3 Sludge Depth

Figure 5 Bin 5/Bin 3 Ridge Sludge (bin 3 left EC half pipe top left bin 6 top right

Figure 6 Bin 5 Sludge Depth

Figure 7 Bin 5, 6, 7, 8 ridge confluence (bin 7 in foreground)

Figure 8 Bin 7 Sludge Depth

Figure 9 Bin 8 ridge Sludge

Figure 10 Bin 8 sludge depth

Figure 11 Bin 6/Bin 5 Ridge Sludge

Figure 12 Bin 6 Sludge Depth (note EC bin drain hole top can be seen)

Figure 13 Bin 4 Sludge Depth

Figure 14 Bin 4/Bin 2 Ridge sludge

Figure 15 Bin 4/Bin 6 Ridge Sludge

Figure 16 Bin 2 Corner Hold up

Figure 17 Bin 2 Sludge Depth

SCS-CON-230 End Point Results

RECORD COPY

1E-18-04301/Y

Engineered Container End Point Criteria Inspection

WCN-2

Table 1. EC End Point Criteria Data

SCS-CON-230	Bin 1	Bin 2	Bin 3	Bin 4	Bin 5	Bin 6	Bin 7	Bin 8	Total
Sludge Depth (in)	1.5	2.0	2.5	3.25	3.0	3.0	2.5	2.75	From attached spreadsheet
	2.5	3.0	3.5	4.25	4.0	4.0	3.5	3.75	plus 1 inch to cover Thin upslope sludge
Estimated Volume (gal)	0.13	0.16	0.22	0.33	0.28	0.28	0.22	0.25	1.87 gallon plus 0.25 gallon for pipes = 2.12 gallons.
OPS (initials/date)	[illegible] 8/27/19	[illegible] 8/27/19	[illegible] 8/27/19	[illegible] 8/27/19	[illegible] 8/27/19	[illegible] 8/27/19	[illegible] 8/27/19	[illegible] 8/27/19	N/A
QA (initials/date)	RJK 8/28/19	RJK 8/28/19	RJK 8/28/19	RJK 8/28/19	RJK 8/28/19	RJK 8/28/19	RJK 8/28/19	RJK 8/28/19	N/A
PCE (initials/date)	[illegible] 8/27/19	[illegible] 8/27/19	[illegible] 8/27/19	[illegible] 8/27/19	[illegible] 8/27/19	[illegible] 8/27/19	[illegible] 8/27/19	[illegible] 8/27/19	N/A
DA						Total Volume remaining in EC is less than or equal to 3 gallons			Sign/Date [illegible] 8/27/19
K Basin Closure Rep						Total Volume remaining in EC is less than or equal to 2.2 gallons			Sign/Date [illegible] 8/28/19
SOM/FM						Total Volume remaining in EC is less than or equal to 3 gallons			Sign/Date [illegible] 8/28/19

EC 230 End Point	BIN 1	BIN 2	BIN 3	BIN 4	BIN 5	BIN 6	BIN 7	BIN 8		Notes
bottom ruler reading (bottom is 0)	0.25	0.75	0.5	1	0.5	0.75	1	1		
bottom ruler length	24	24	24	24	24	24	24	24		
top ruler reading (top is 0)	5.5	5.5	6.25	6.5	6.75	6.5	5.75	6		
top ruler length	24	24	24	24	24	24	24	24		
EC depth to sludge	86.25	85.75	85.25	84.5	84.75	84.75	85.25	85		Length and cal of measuring tool
EC depth	87.75	87.75	87.75	87.75	87.75	87.75	87.75	87.75		
sludge depth (in)	1.5	2	2.5	3.25	3	3	2.5	2.75		
sludge volume (gal)	0.06	0.09	0.13	0.19	0.16	0.16	0.13	0.15	1.07	
add inch for conservatism	2.5	3	3.5	4.25	4	4	3.5	3.75		conservative estimate to cover thin upslope of bin
conservative sludge volume	0.13	0.16	0.22	0.33	0.28	0.28	0.22	0.25	1.87	conservative estimate to cover thin upslope of bin
								pipes	0.25	2 pipes had pyrmid of sludge on them across the width of the EC
								total	2.12	

PCE [illegible] 8/27/19
DDL 8/27/19

Spreadsheet equations:
EC depth to sludge = (Bottom ruler length − Bottom ruler reading) + Length between ruler [44"] + (Top ruler length − ~~Bottom~~ Top ruler reading) DL 8-28-19
Sludge depth (in) = EC depth − EC depth to sludge
EC depth derived from H-1-88419, DDL 8/28/19

Explanation of Engineer Container (EC) End Point spreadsheet found in 1E-18-04301/Y.

The ruler used in ECs is 92 inches long from under the plate to the end. It has a 24 inch ruler at the top starting under the plate (top is 0 inches). The bottom ruler is also 24 inches and starts at 0 inches at the bottom. In between the two rulers is a gap of 44 inches.

The equations used on the spreadsheet are:

EC depth to sludge = (bottom ruler length – Bottom ruler reading) + Length between rulers [44 inches] + (Top ruler length – Top ruler reading)

Sludge depth (in) = EC depth – EC depth to sludge

The sludge volume (gal) is read or interpolated from Figure 1 in 1E-18-04301/Y.

The sludge depth and conservative sludge depth are both entered on Table 1.

Estimated Volume (gal) on Table 1 uses the conservative volume. Sometimes an additional adjustment is added for miscellaneous other sludge holdup.

Don Craig

DA ECRTS Retrieval System

DCraig 8-28-19

27 Dou Craig

8/~~26~~/19 End point

inspection of SCS-CON-230

NOTES

measurement

TOP 5 1/2

(5) Bottom 0-1/4"

(6) T 6 1/4

B 1/2

(7) T 6 3/4

B 1/2

(8) T 5 3/4

B 1

1 2 3 4 5 6 7 8

5 1/2 T

3/4 B (4)

6 1/2 T

1 B (3)

6 1/2 6 1/2 T (2)

3/4 3/4 B (2)

6 5 3/4 T

8 1 B

~~6 1/2 T~~

~~3/4 B~~

(1)

(8)

8/27/19

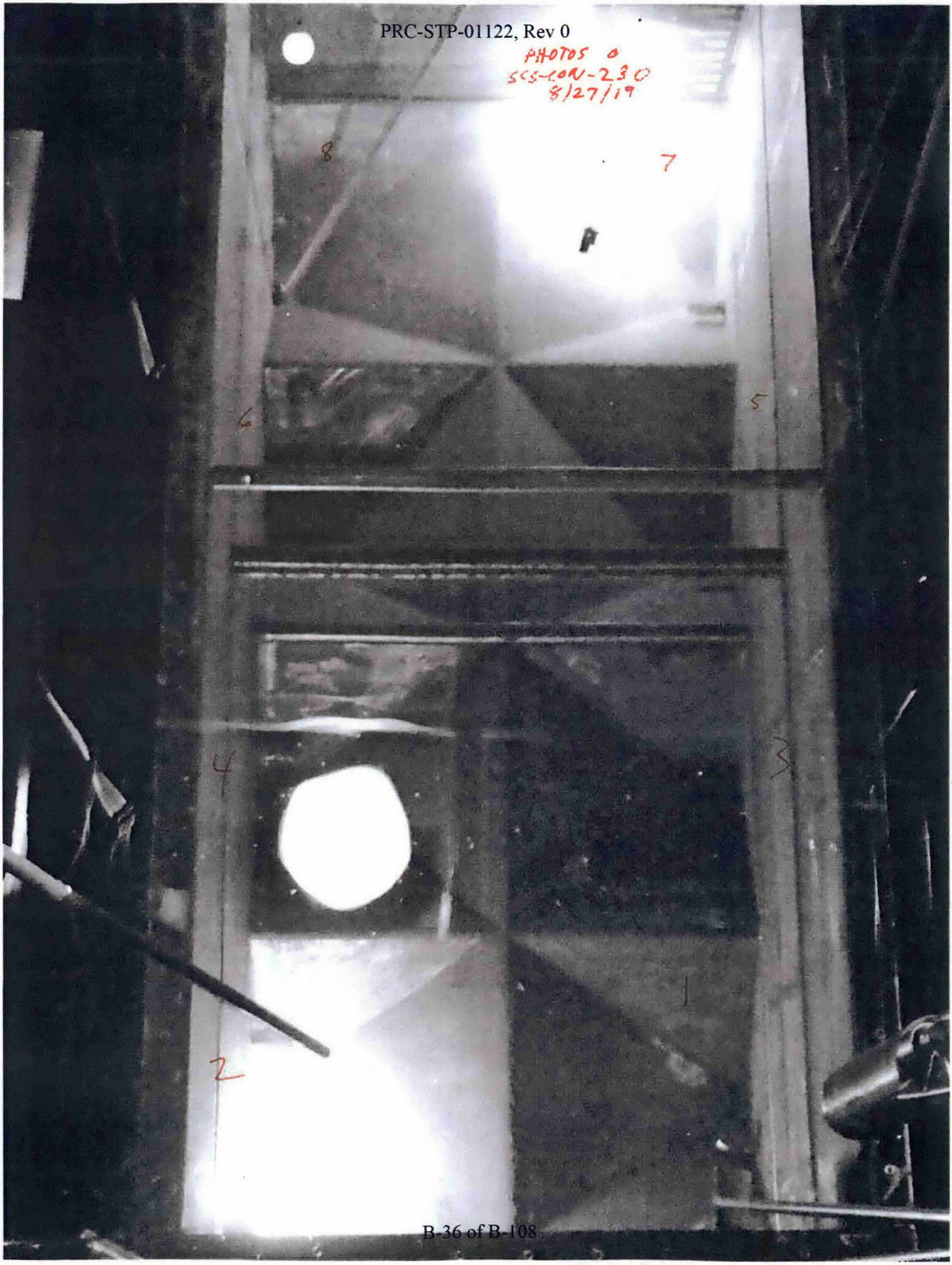
Third attempt.

Panoramic of Pipes

B/N 6 scratch very thin sludge

B/N 1 → B/N 2 scratch - some small patches with some dimension (~1/8 to estimate)

8/27/19


PHOTOS 0
SCS-CON-230
8/27/19
8
7
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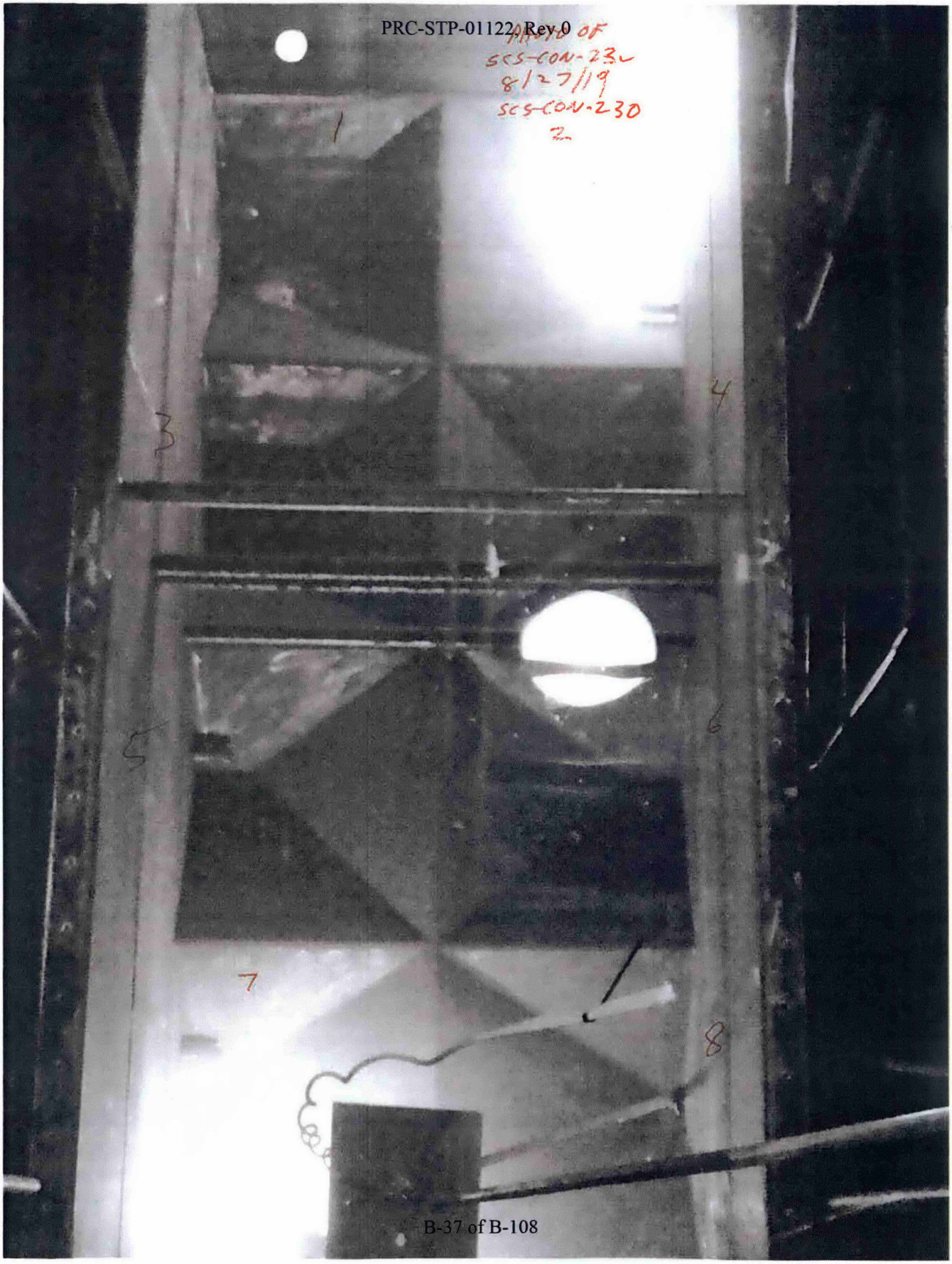
PHOTO OF
SCS-CON-23
8/27/19
SCS-CON-230
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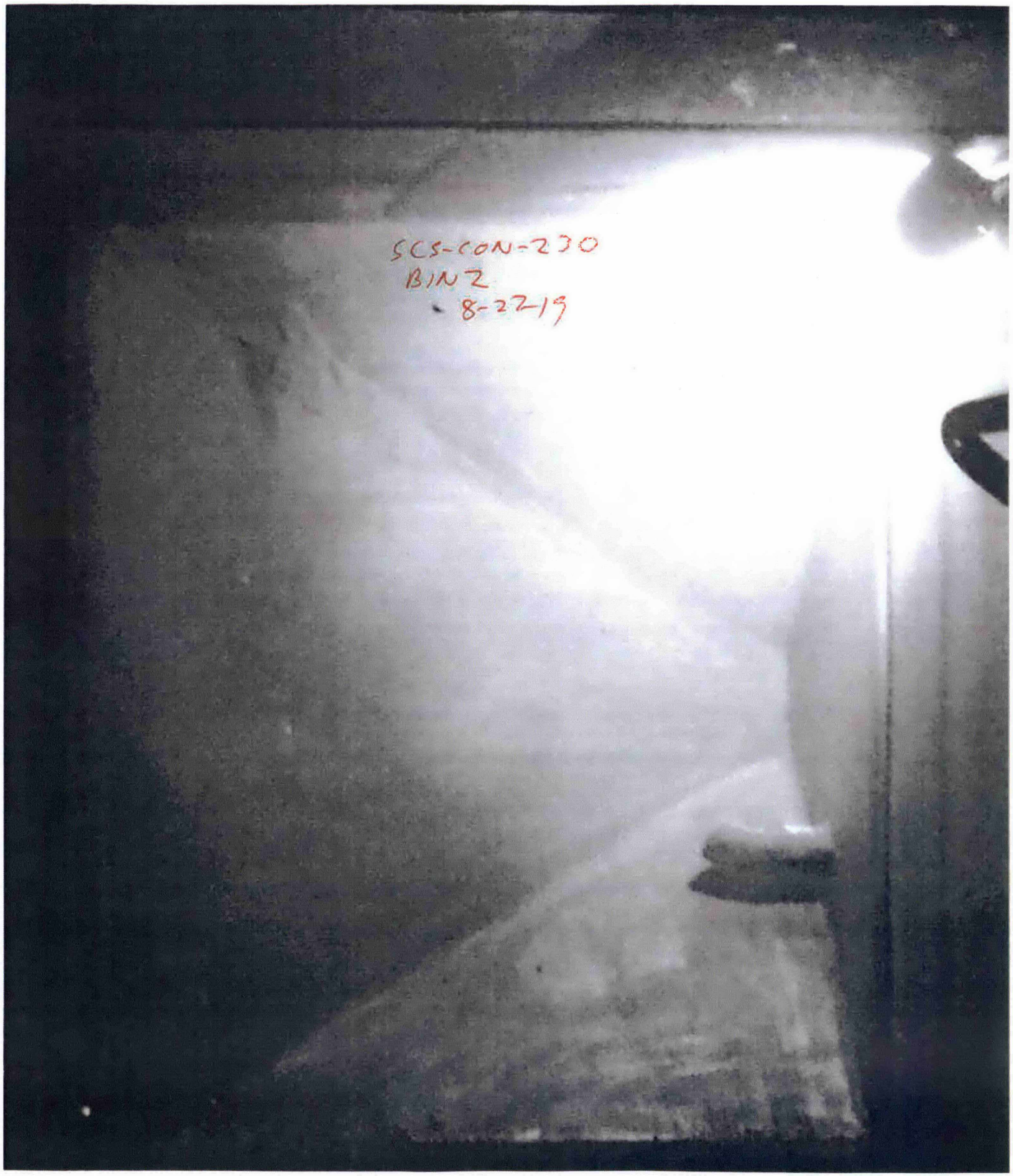

SCS-CON-230
BIN 2
8-22-19

SCS-CON-236
BIN 7
8/27/19

SCS-CON-240 End Point Results

Engineered Container End Point Criteria Inspection

WCN-2

Table 1. EC End Point Criteria Data

SCS-CON-240	Bin 1	Bin 2	Bin 3	Bin 4	Bin 5	Bin 6	Bin 7	Bin 8	Total
Sludge Depth (in)	7.25	5.75	9	10.25	4.5	2.75	5.25	5.5	see attached spread sheet.
Estimated Volume (gal)	2.0	1.4	2.9	4.0	0.9	0.7	1.0	1.1	13.9 see spreadsheet.
OPS (initials/date)	gc 9/5/19	gc 9/5/19	gc 9/5/19	gc 9/5/19	gc 9/5/19	gc 9/5/19	gc 9/5/19	gc 9/5/19	N/A gc 9/5/19
QA (initials/date)	RJK 9/05/19	RJK 9/05/19	RJK 9/05/19	RJK 9/05/19	RJK 9/05/19	RJK 9/05/19	RJK 9/05/19	RJK 9/05/19	N/A RJK 9/05/19
PCE (initials/date)	[illegible] 9/4/19	[illegible] 9/4/19	[illegible] 9/4/19	[illegible] 9/4/19	[illegible] 9/4/19	[illegible] 9/4/19	[illegible] 9/4/19	[illegible] 9/4/19	N/A [illegible] 9/4/19
DA						Total Volume remaining in EC is less than or equal to 14 gallons			Sign/Date [illegible] 9/4/19
K Basin Closure Rep						Total Volume remaining in EC is less than or equal to 14 gallons			Sign/Date [illegible] 9/5/19
SOM/FM						Total Volume remaining in EC is less than or equal to 14 gallons			Sign/Date [illegible] 9/5/19

EC 240 End Point	BIN 1	BIN 2	BIN 3	BIN 4	BIN 5	BIN 6	BIN 7	BIN 8		Notes
Bottom ruler reading (bottom is 0) (in.)	5.25	3.75	7	8.5	2.5	1.5	3.25	3.75		
Bottom ruler length (in.)	24	24	24	24	24	24	24	24		
Top ruler reading (top is 0)(in.)	6.25	6.25	6.25	6	6.25	5.5	6.25	6		
Top ruler length (in.)	24	24	24	24	24	24	24	24		
EC depth to sludge (in.)	80.5	82	78.75	77.5	83.25	85	82.5	82.25		Based on length of measuring tool 92". See formula below.
EC depth	87.75	87.75	87.75	87.75	87.75	87.75	87.75	87.75		
Sludge depth (in.)	7.25	5.75	9	10.25	4.5	2.75	5.25	5.5		
UpSlope Sludge volume (gal)	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	1.4	assume 1/16" thick on shallow EC slopes only
Additional sludge masses (gal)	1		0.5		0.75		0.5		2.75	
Sludge volume (gal)	1.32	0.71	2.43	3.56	0.38	0.14	0.56	0.63	9.73	Figure 1 of 1E-18-4301 interpolated.
Conservative sludge volume (gal)	2.0	1.4	2.9	4.0	0.9	0.7	1.0	1.1	13.9	Based on other observed sludge

EC depth to sludge formula: Bottom ruler length (24") minus bottom ruler reading + Top ruler length (24") minus top ruler reading + Distance between rulers (44").

EC Depth of 87.75" derived from drawing H-1-88419, KW SRSS/SCS Sludge Container Assembly.
Sludge Depth = EC Depth minus EC depth to sludge.

Total Sludge volume from Figure 1.	9.73
Rough estimate of 1/16 in of sludge on shallow EC slopes ~	1.4 gal
4 major sludge clumps on EC ridges were observed totaling ~	2.75 gal
Remaining Sludge Estimate =	13.88 gal

D.D. Craig 9/4/19
Ron Kidder RJK 9/05/19

Don Craig
9/4/19 dc

END POINT INSPECTION NOTES

SCS-CON-240

mark areas of clamps and holdups upslope.

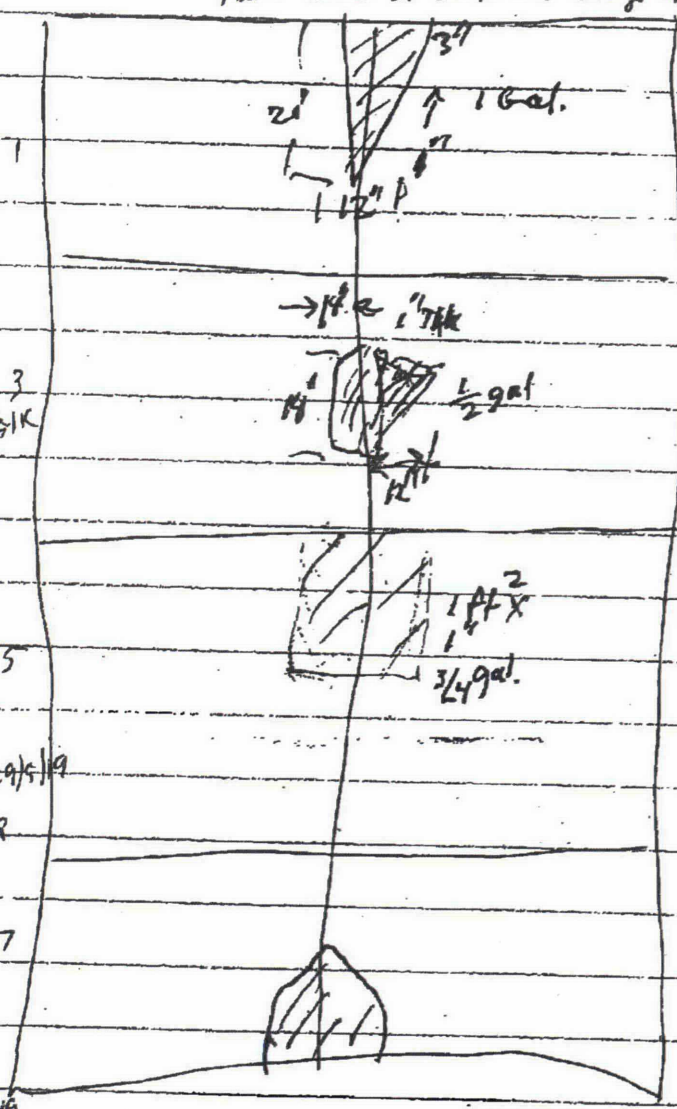
9-3-19

Top 6 1/4"
Bottom 5 1/4"
OTHER 1

T 6 1/4"
B ~~[illegible]~~"
OTHER 3 RJK 9/05/19 DC 9/5/19

T 6 1/4"
B ~~[illegible]~~"
OTHER 2 1/2" DC 9/5/19 RJK 9/05/19

T 6 1/4" 7
B ~~3 1/4~~" 3 1/4" DC 9/5/19
OTHER RJK 9/05/19



T ~~8~~ 6 1/4"
B 3 3/4"
2 OTHER

T 6 ~~[illegible]~~" RJK 9/05/19 DC 9/5/19
4 B 8 1/2"
OTHER

T 5 1/2"
6 B 1 1/2"
OTHER

T 6"
8 B 3 3/4"
OTHER

shallow slopes 1/16"? → 1.4 gal
1 pipe 60° triangle 1" w/sh = 30 in³ 1/8 gal
3 Ridge clamps = 1 + 1/2 + 3/4 = 2 1/4 gal
~ 3 3/4 gal

1 gallon = 231 in³

05 RJK 9/05/19

RON KIDDER RJK 9/04/19

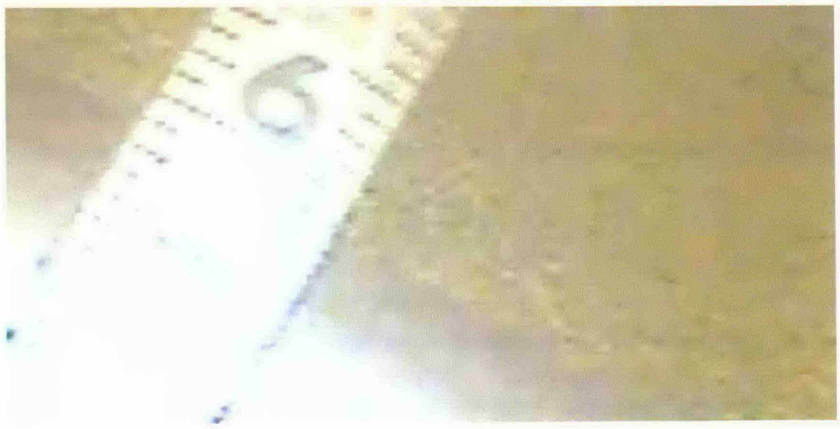
09/04/2019 14:04 FAX 001/001

NOTE: All ruler readings listed under images are the numbers recorded in the field. The screen shots do not necessarily represent the view seen live in the field that was used for sludge level. Screen shot quality is not good due to poor quality of the original photos and videos. In addition, the screen capture software tends to degrade the image. Some images have light and contrast adjusted to bring out detail.

CON-240 Bin 1

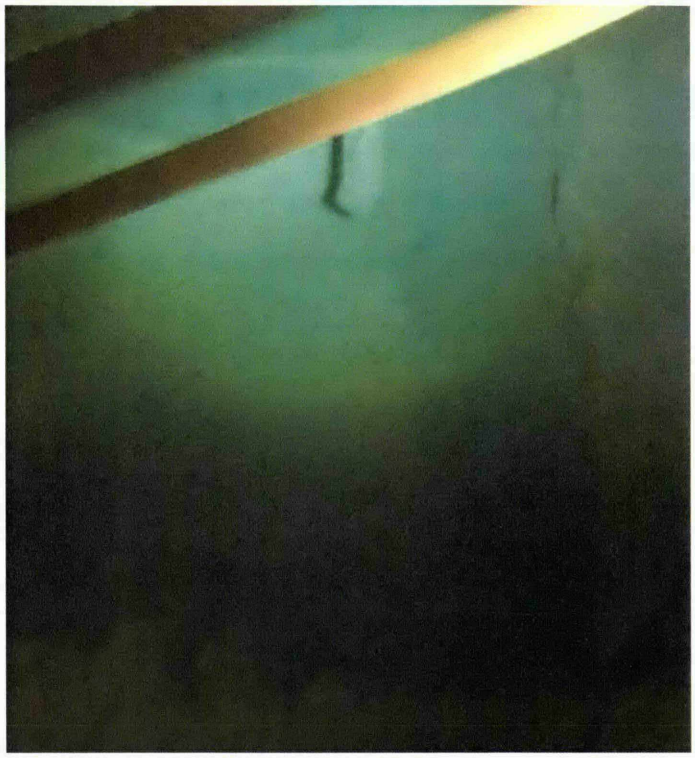
Bin 1

Bin 1



Bin 1 Top Reading: 6 ¼ inches

Bin 1 Bottom Reading: 5 ¼ inches



CON-240 Bin 2

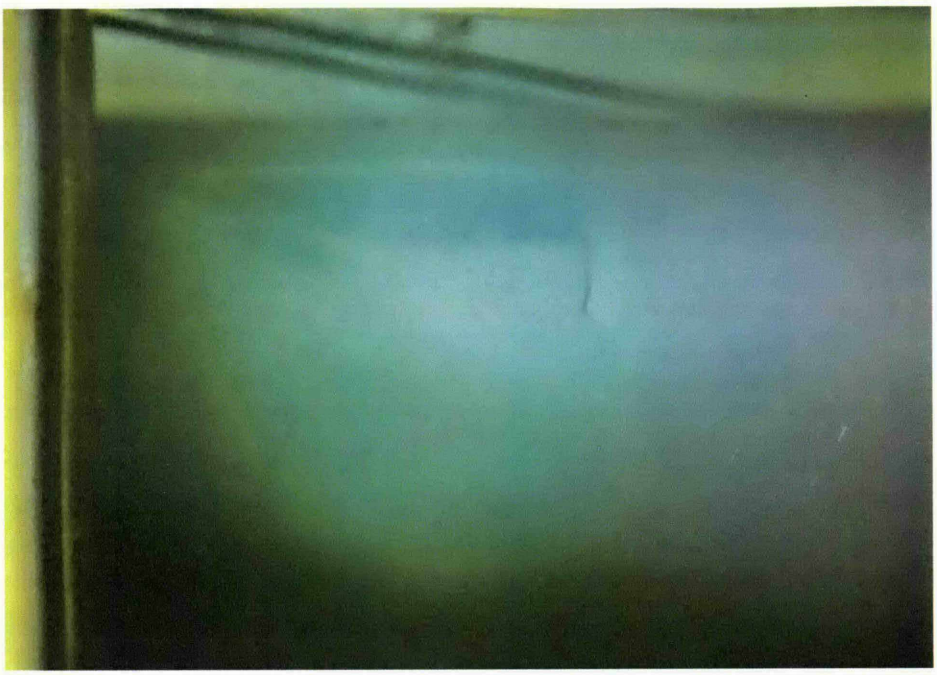
Bin 2 and Ridge sludge between Bins 1 and 2

North end with measuring stick in Bin 2.

Bin 2

Bin 2 Top Reading: 6 ¼ inches

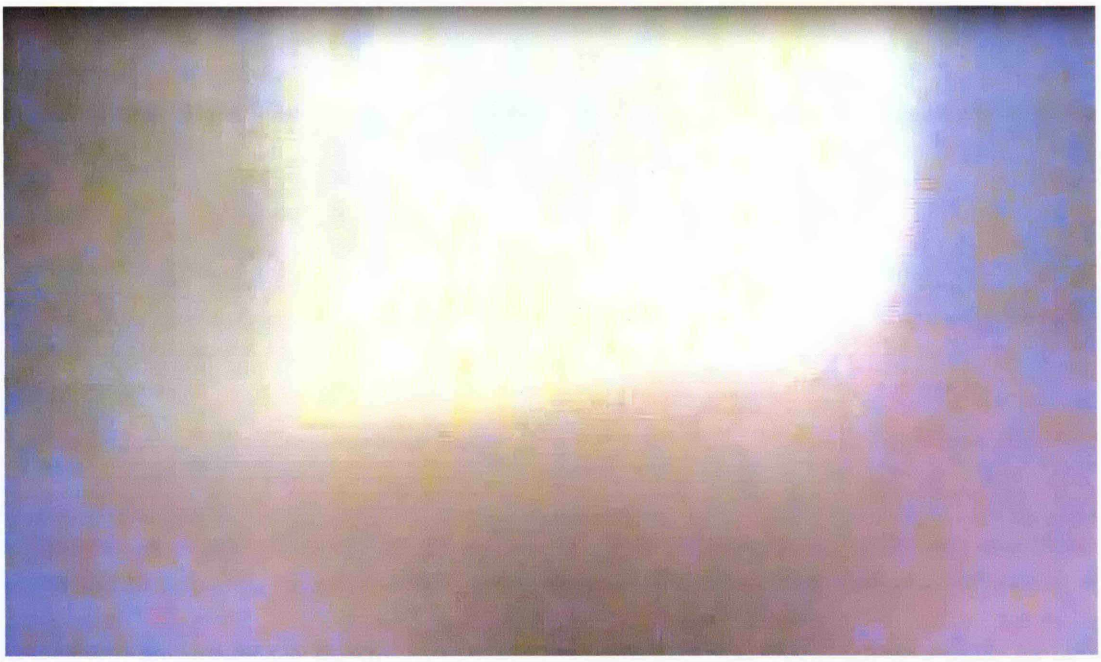
Bin 2 Bottom Reading: 3 ¾ inches



CON-240 Bin 3

Bin 3

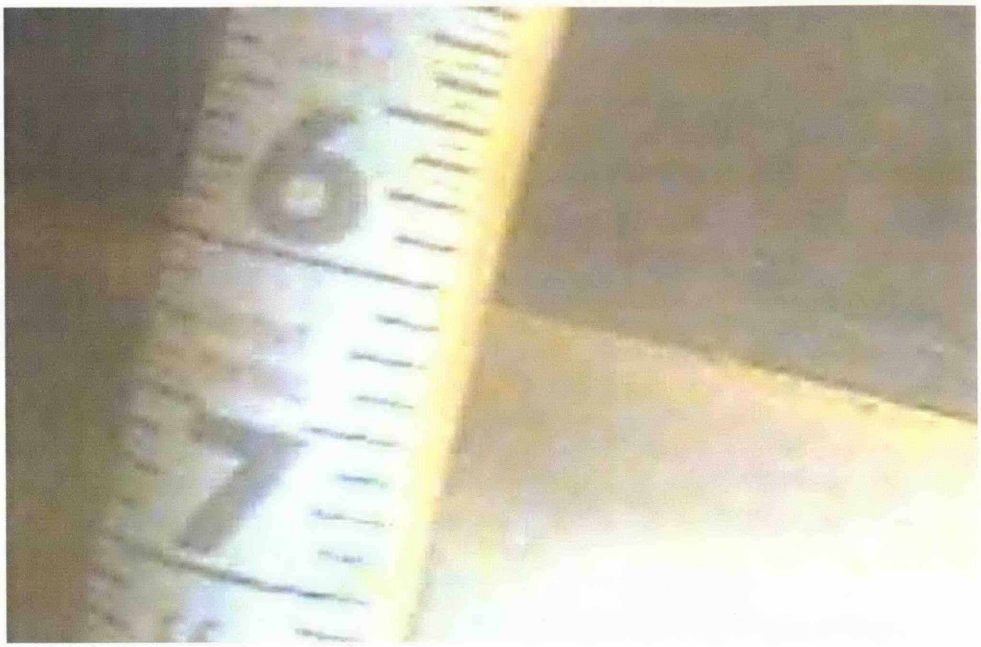
Bin 3 Top Reading: 6 ¼ inches



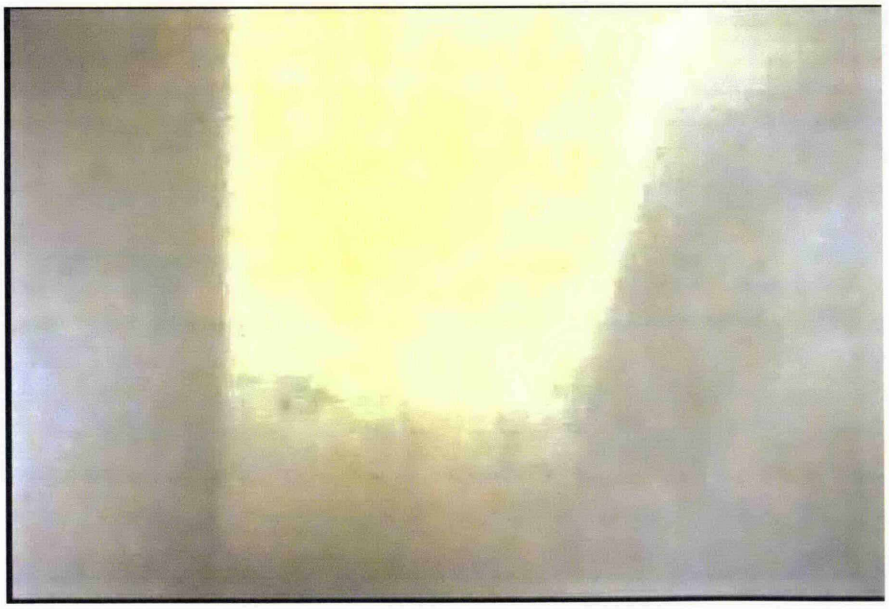
Bin 3 Bottom Reading: 7 inches (Could not capture the 8-inch mark above this image and sludge level in the same frame.)

CON-240 Bin 4

Bin 4

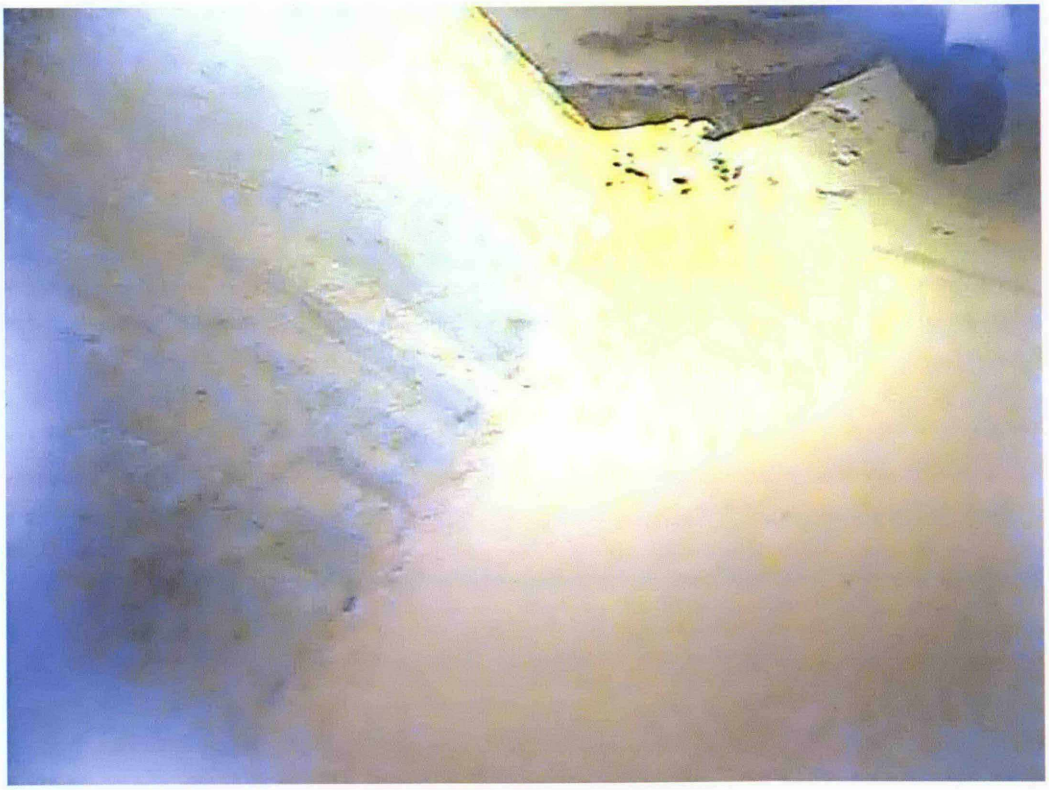


Bin 4 Top Reading: 6 inches



Bin 4 Bottom Reading: 8 ½ inches in the field (probably lower, but much clouding)

CON-240 Bin 5



Bin 5

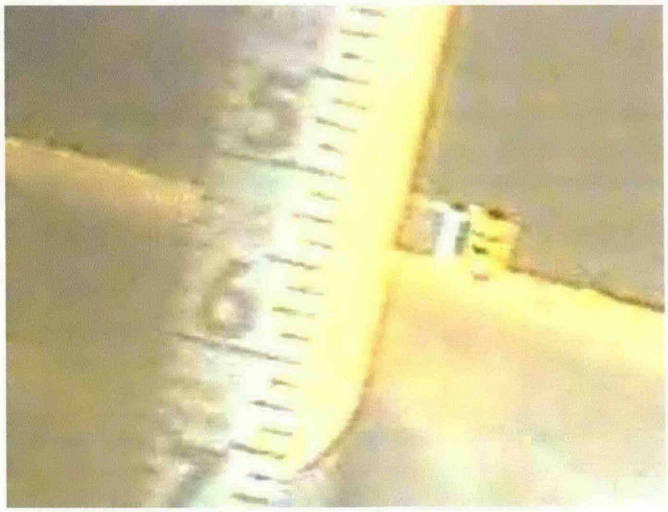
Bin 5 Top Reading: 6 ¼ inches

Bin 5 Bottom Reading: 2 ½ inches

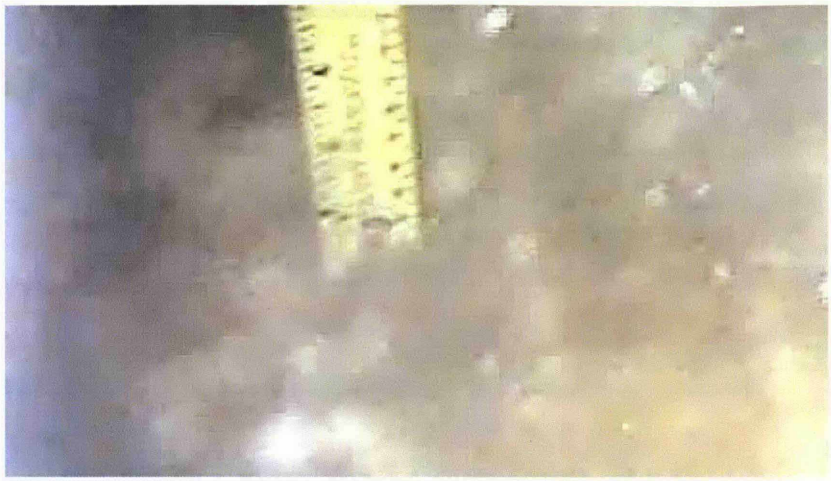
CON-240 Bin 6

Bin 6

Bin 6 and ridge sludge between Bins 6 and 5.



Bin 6 Top Reading: 5 ½ inches

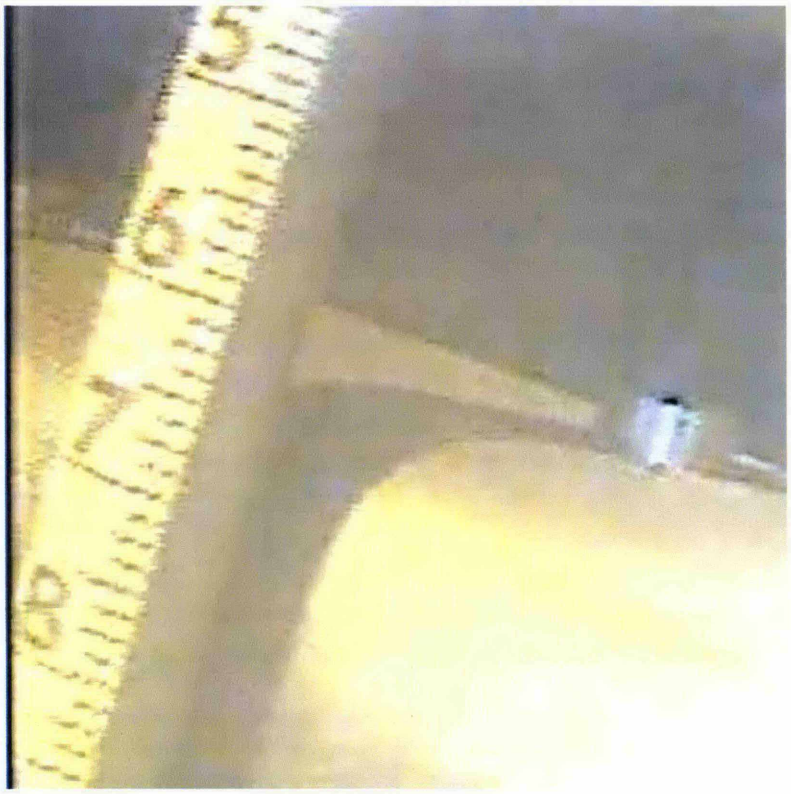


Bin 6: 1 ½ inches (Field reading. Actual is probably more like one inch).

CON-240 Bin 7

Bin 7

Bin 7



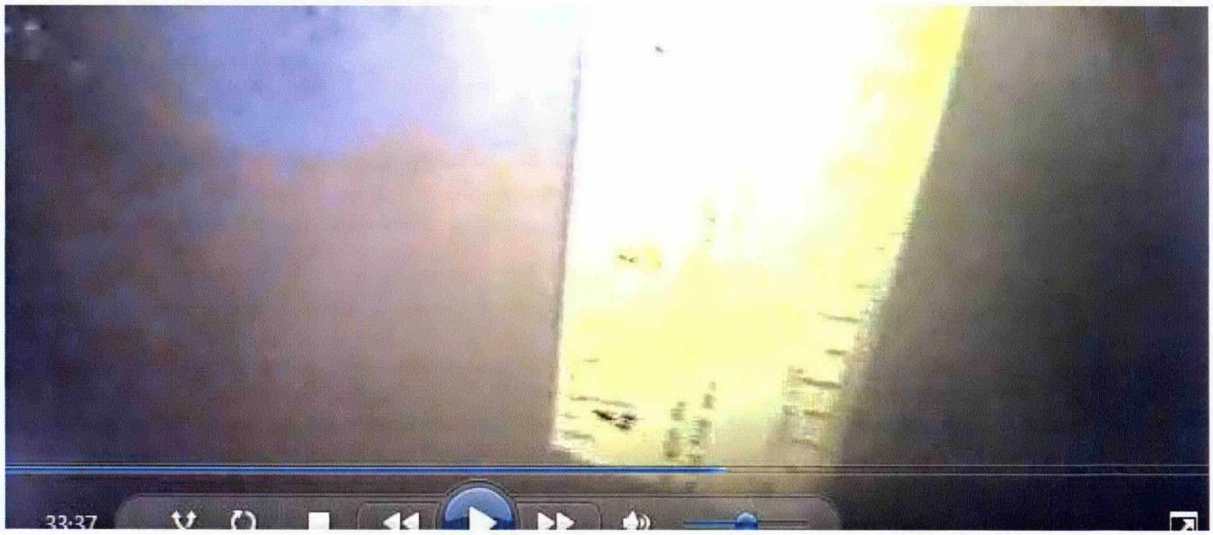
Bin 7 Top Reading: 6 ¼ inches

Bin 7 Bottom Reading: 3 ¼ inches

CON-240 Bin 8

Bin 8

Bin 8 Top Reading: 6 inches



Bin 8 Bottom Reading: 3 ¾ inches

Sludge between ridge and cross pipe looking from Bin 5 toward Bin 3.

South wall ridge sludge between Bins 7 and 8. From the top of the ridge under the sludge to the seam (top right) is one inch.

South side of center mound at cross pipes. Top of mound is about one inch tall. For scaling the gap between bottom of pipe and top of egg crate ridge is two inches (when no sludge is present).

SCS-CON-250 End Point Results

RECORD COPY

1E-18-04301/Y

Engineered Container End Point Criteria Inspection

WCN-1

Video adjusted.

Table 1. EC End Point Criteria Data

SCS-CON-250	Bin 1	Bin 2	Bin 3	Bin 4	Bin 5	Bin 6	Bin 7	Bin 8	Total
Sludge Depth (in)	13 1/4	12 1/4	10 3/4	8	8 3/4	10	7	10	N/A
Estimated Volume (gal)	8	6	5	2	3	4	2	4	Total maximum volume allowed 8 gallons 34
OPS (initials/date)	3/28/19	3/28/19	3/28/19	3/28/19	3/28/19	3/28/19	3/28/19	3/28/19	
QA (initials/date)	RJK 3/28/19	RJK 3/28/19	RJK 3/28/19	RJK 3/28/19	RJK 3/28/19	RJK 3/28/19	RJK 3/28/19	RJK 3/28/19	
PCE (initials/date)	3/28/19	3/28/19	3/28/19	3/28/19	3/28/19	3/28/19	3/28/19	3/28/19	
DA						Total Volume remaining in EC is less than or equal to 8 gallons ☐ Yes ☑ No			Sign/Date 3/28/19 D.D. Craig
K Basin Closure Rep						Total Volume remaining in EC is less than or equal to 8 gallons ☐ Yes ☑ No			Sign/Date PTC FOR PETE SAUER 3/28/19
SOM/FM						Total Volume remaining in EC is less than or equal to 8 gallons ☐ Yes ☑ No			Sign/Date Jim Buescher 3/28/19

RECORD COPY

1E-18-04301/Y

Engineered Container End Point Criteria Inspection

WCN-1

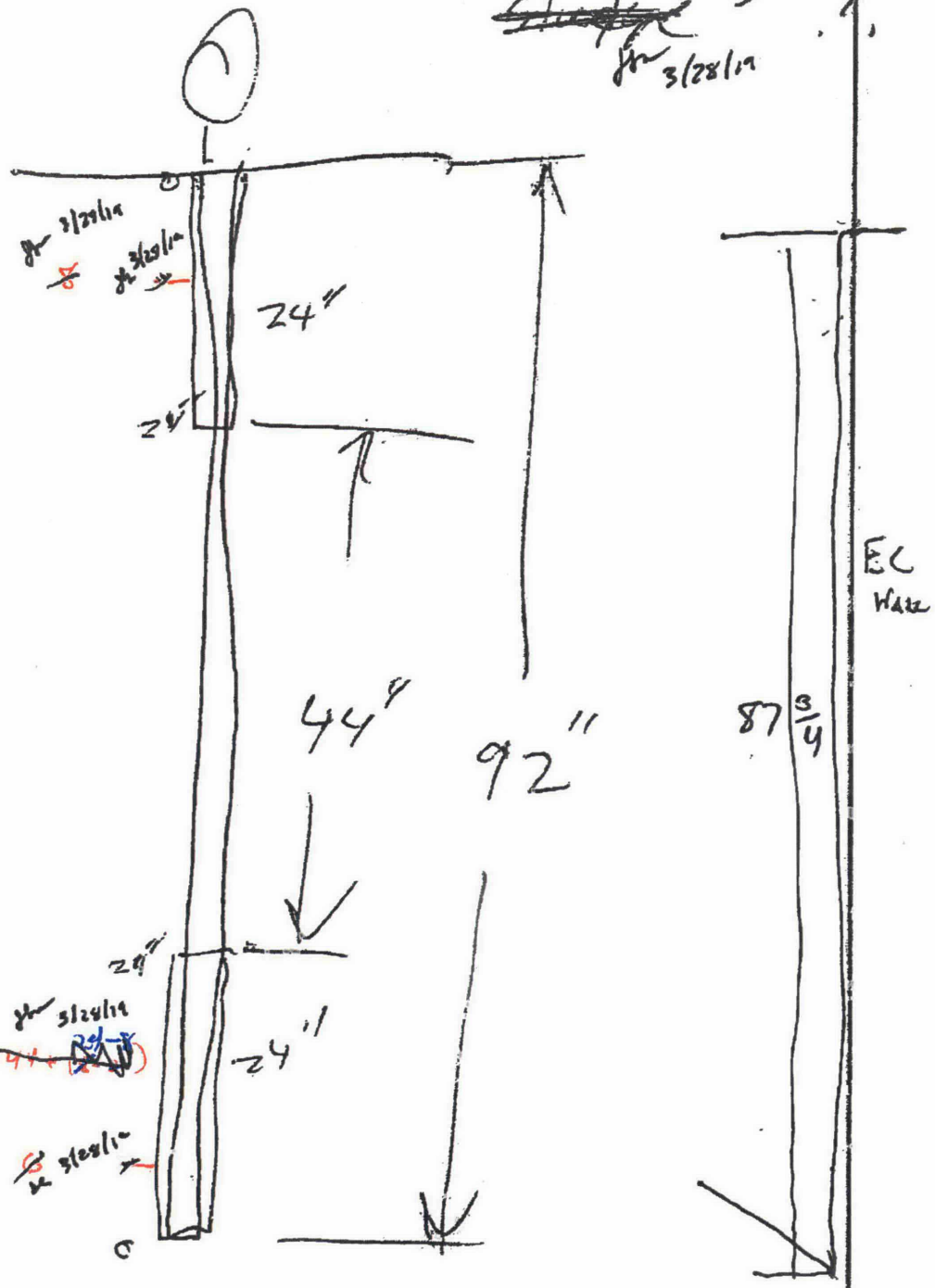
Table 1. EC End Point Criteria Data

UPSIDE OF P

SCS-CON-250	Bin 1	Bin 2	Bin 3	Bin 4	Bin 5	Bin 6	Bin 7	Bin 8	Total
Sludge Depth (in)	TOP 9 3/4 BOT 8	TOP 11 BOT 5.5	TOP 11 1/2 BOT 4	TOP 7 BOT 5.5	TOP 6.25 BOT 7.5	TOP 11 3/2 BOT 3 TOP OF PIPE	TOP 7 BOT 4	BECON PIPE TOP 13 4 BOT TOP OF P PIPE 3	
Estimated Volume (gal)									Total maximum volume allowed 8 gallons
OPS (initials/date)				FIELD DATA					
QA (initials/date)				SEE WORK RECORD & VIDEO					
PCE (initials/date)				ADJUSTED NUMBERS		3/28/19			
DA						Total Volume remaining in EC is less than or equal to 8 gallons ☐ Yes ☐ No			Sign/Date
K Basin Closure Rep						Total Volume remaining in EC is less than or equal to 8 gallons ☐ Yes ☐ No			Sign/Date
SOM/FM						Total Volume remaining in EC is less than or equal to 8 gallons ☐ Yes ☐ No			Sign/Date

END POINT CRITERIA
MEASUREMENT DEVICE

SCS CONTAINER
Sludge measuring Tool
~~Sludge~~
JR 3/28/19



If sitting Roller
SLUDGE Depth =

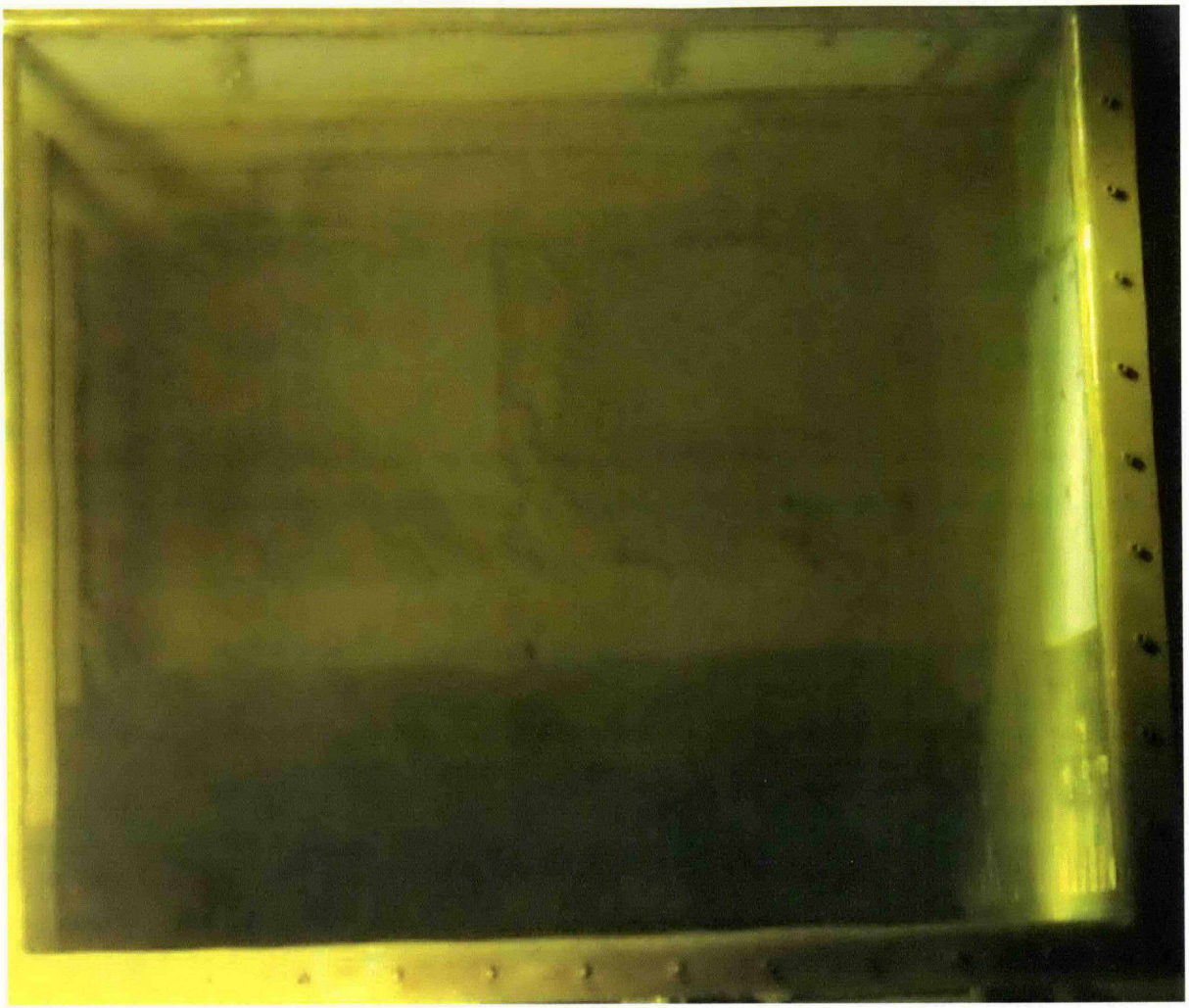
If above Rollers

SCS-CON-250 END POINT CALC SHEET

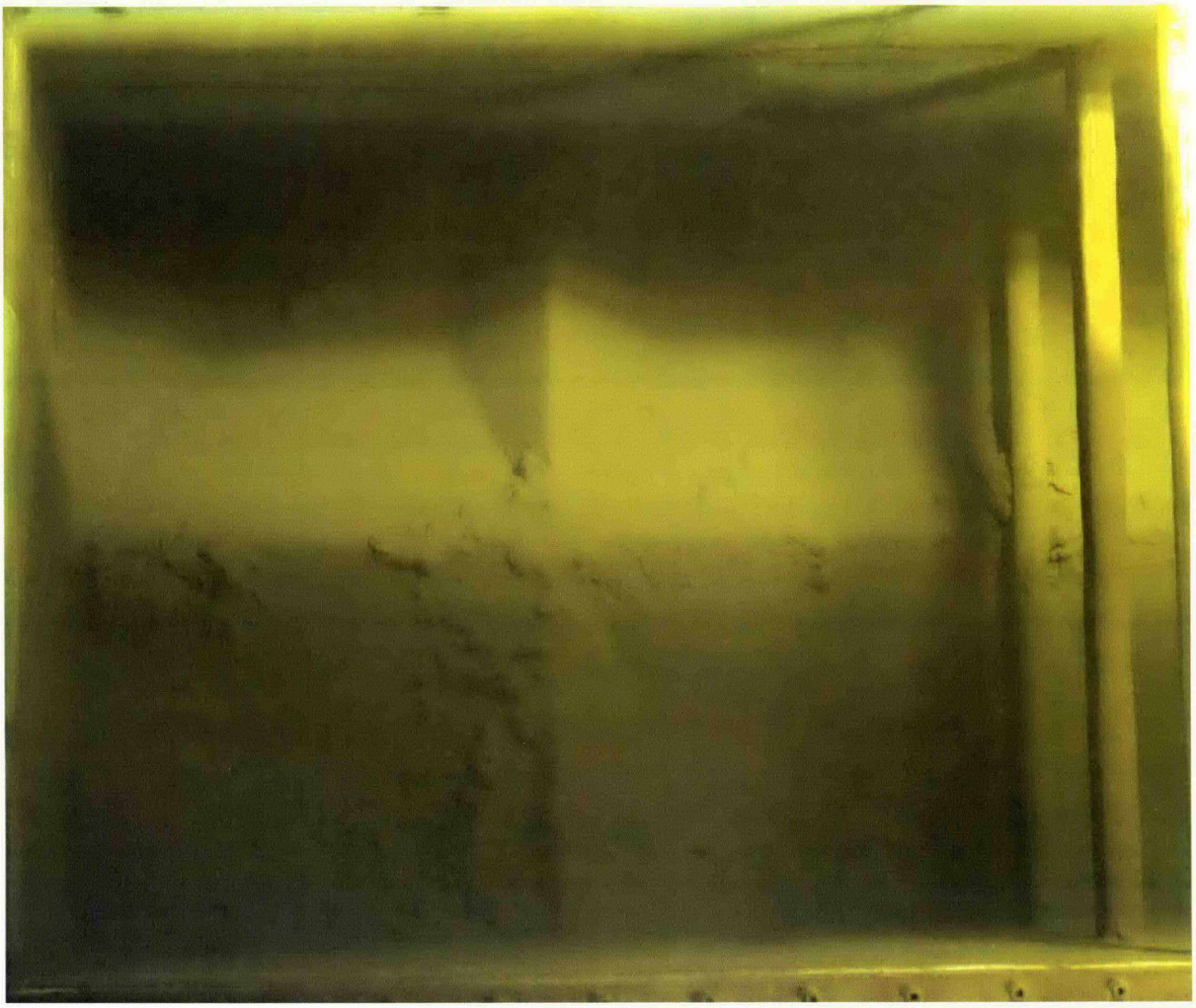
	BIN 1	BIN 2	BIN 3	BIN 4	BIN 5	BIN 6*	BIN 7	BIN 8*		Notes
bottom ruler reading (bottom is 0)	8	5.5	3.5	5.25	7.5	3	4.25	3		bin 6 and bin 8 were to top of pipe but sludge level below
bottom ruler length	24	24	24	24	24	24	24	24		
top ruler reading (top is 0)	9.5	11	11.5	7	5.5	11.5	7	11		
top ruler length	24	24	24	24	24	24	24	24		
EC depth to sludge	74.5	75.5	77	79.75	79	77.5	80.75	78		Length and cal of measureing tool
EC depth	87.75	87.75	87.75	87.75	87.75	87.75	87.75	87.75		
sludge depth (in)	13.25	12.25	10.75	8	8.75	10.25	7	9.75		
						10		10		
sludge volume (gal)	8	6	5	2	3	4	2	4	34	
real gal	7.5	5.98	4.08	1.74	2.25	3.29	1.19	3.29	29.32	

D D. Craig 3/28/19

KJ McCracken 3/28/19



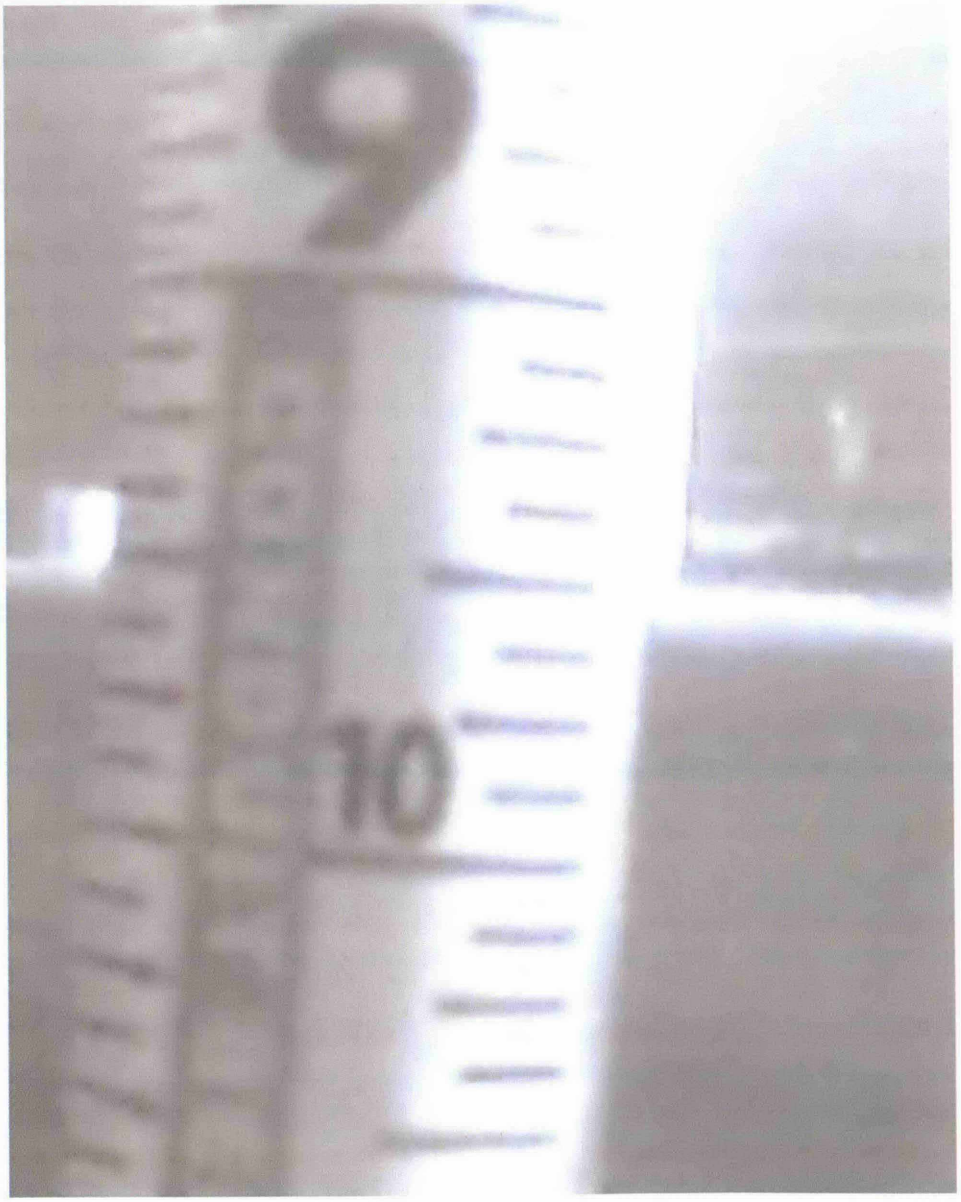
North End



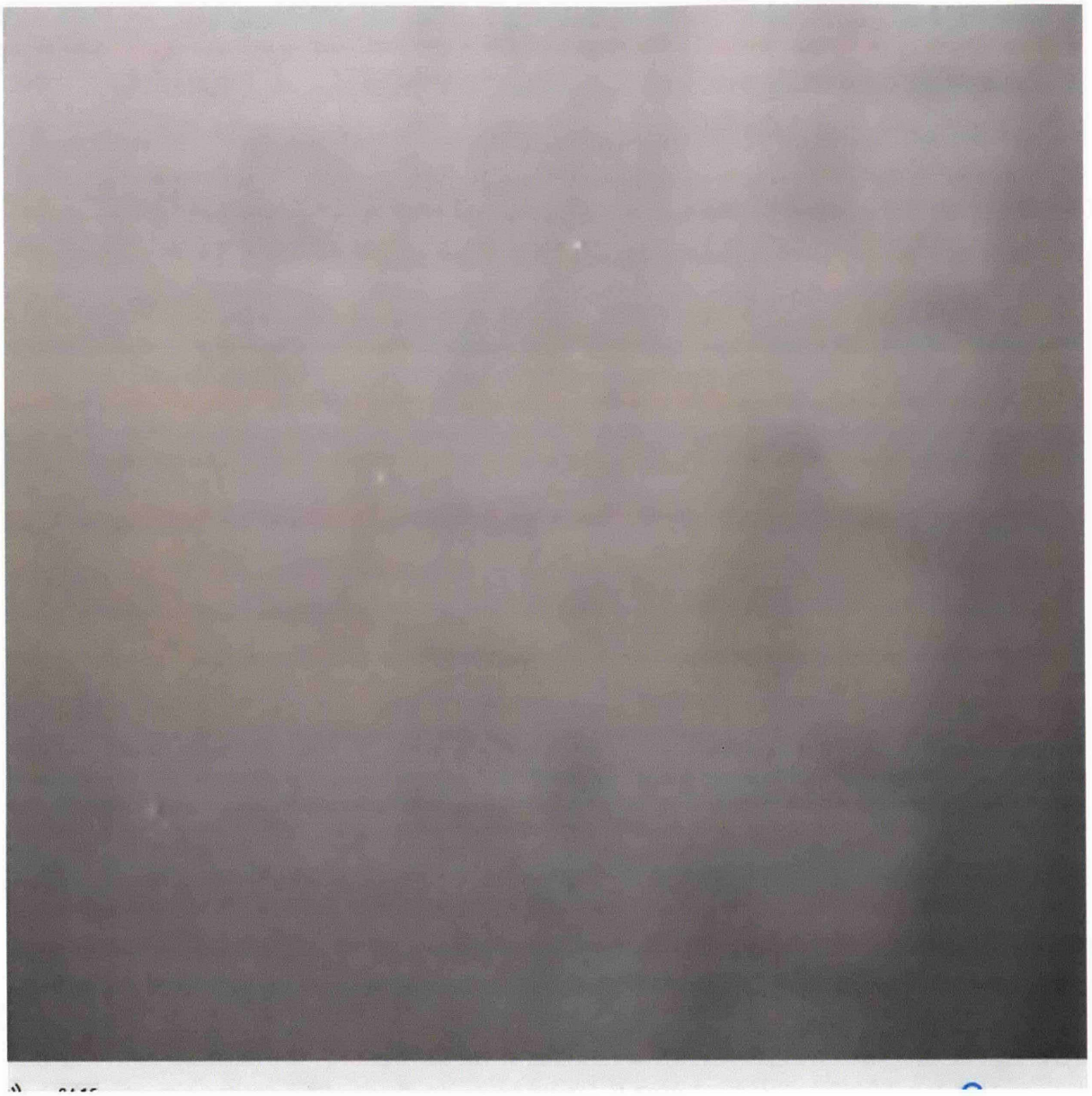
South End

The following images were captured from videos take 3/28/19 and added to the work package on 9/12/19 by D. D. Craig. Additional comments also from D. D. Craig.

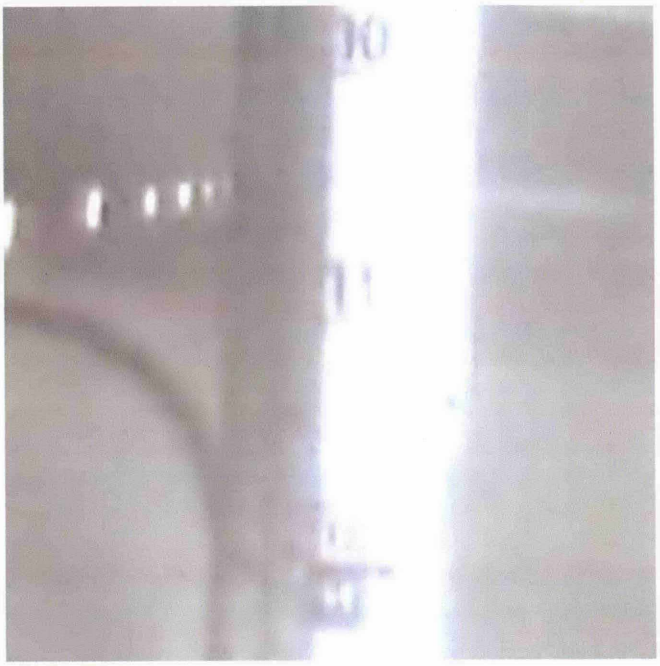
NOTE: All ruler readings listed under images are the numbers recorded in the field or adjusted. The screen shots do not necessarily represent the view seen live in the field that was used for sludge level. Screen shot quality is not good due to poor quality of the original photos and videos. In addition, the screen capture software tends to degrade the image.



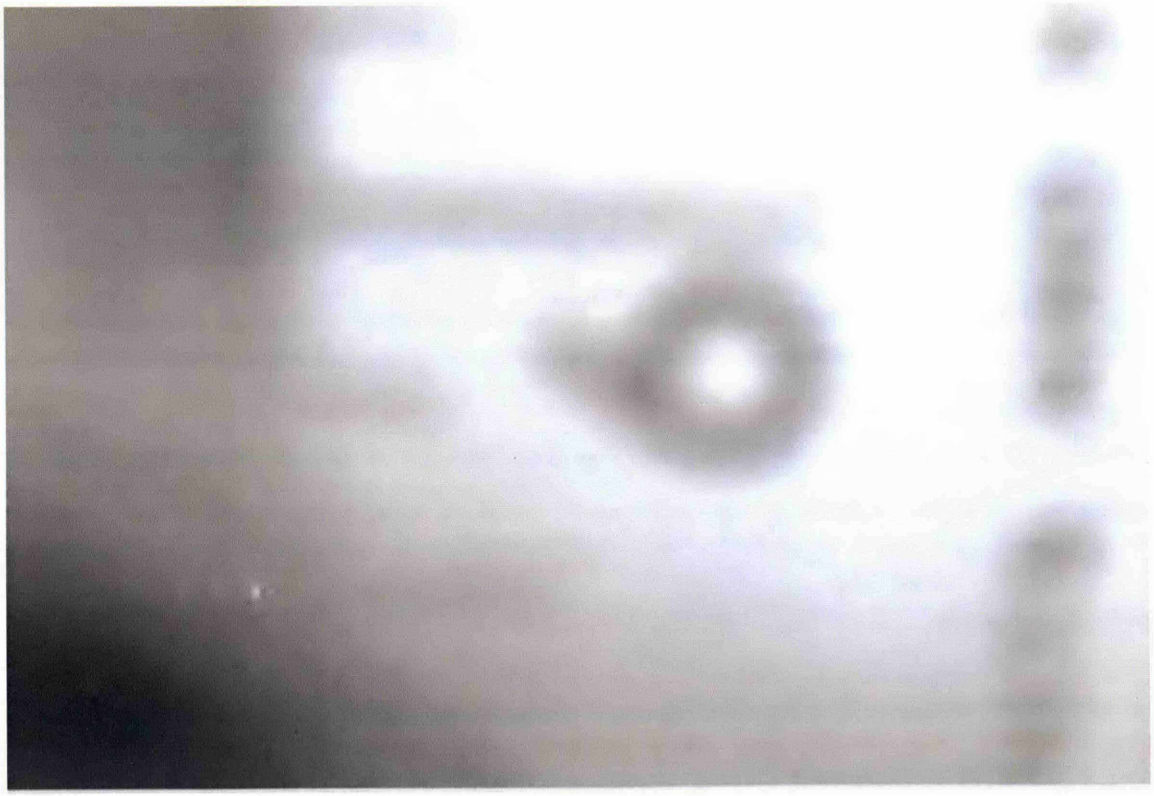
Bin 1 Top Reading: 9 ½ inches



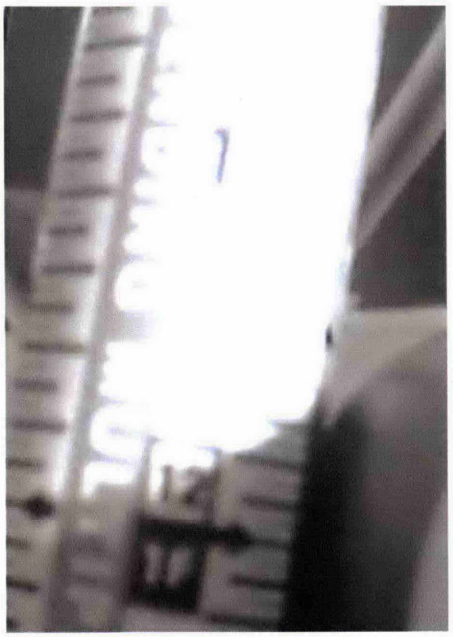
Bin 1: This view shows last legible number of 10 inches. Nine inches would be about the bottom of the image and the video goes dark somewhere past the 9 (not visible in this image capture). Bottom Reading of 8 inches estimated.



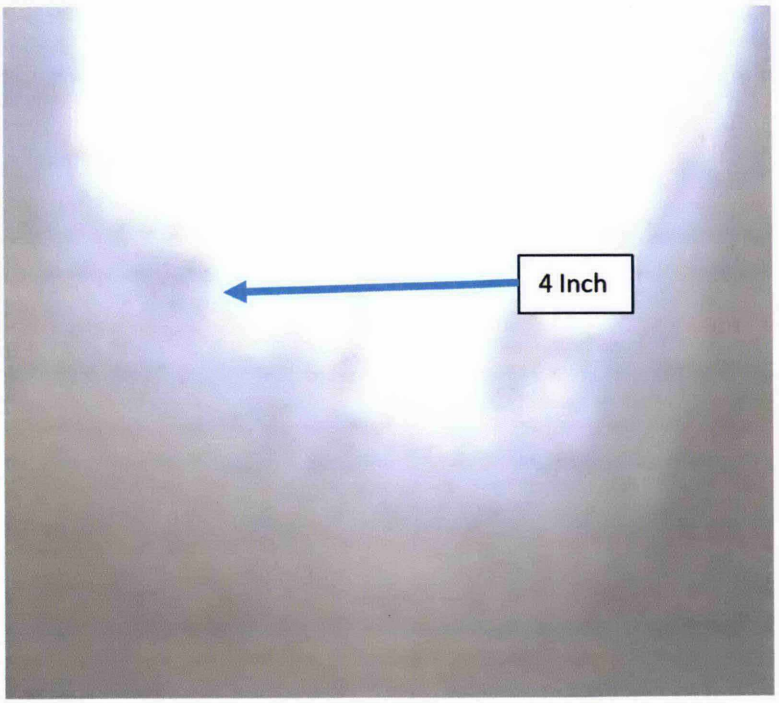
Bin 2 Top Reading: 11 inches.



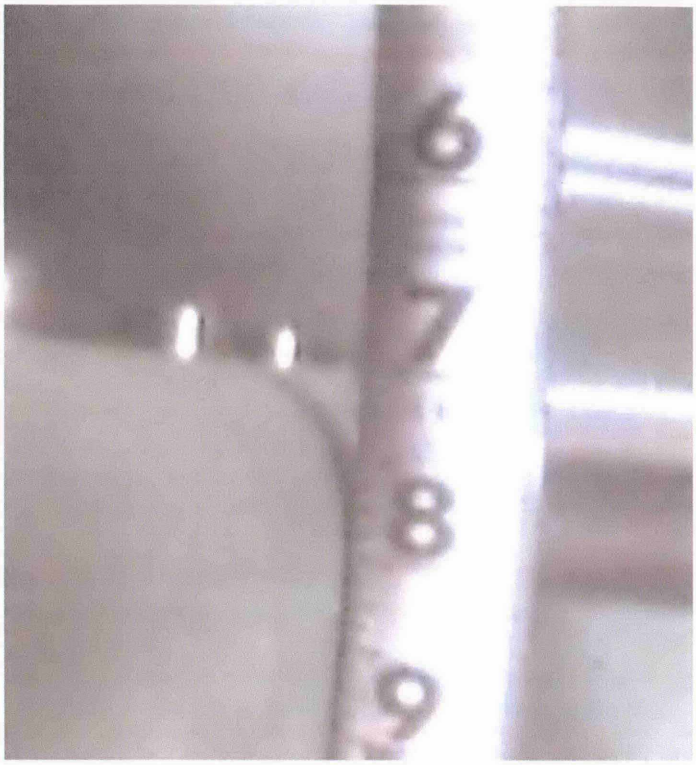
Bin 2 Bottom Reading: 5 ½ inches (On video it appears that the sludge layer is actually lower, but the camera was not repositioned to find the bottom.)



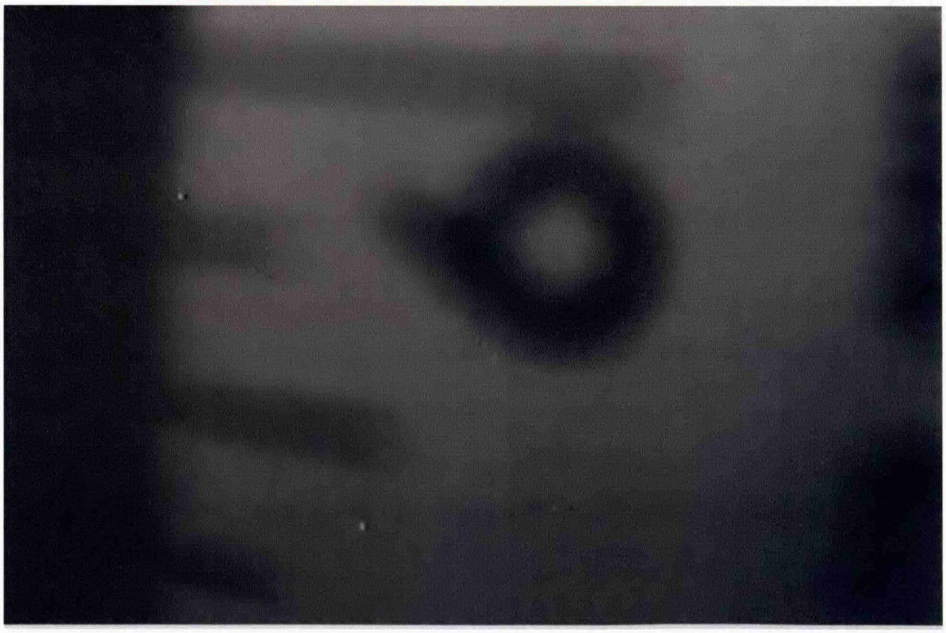
Bin 3 Top Reading: 11 ½ inches



Bin 3 Bottom Reading: 3 ½ inches

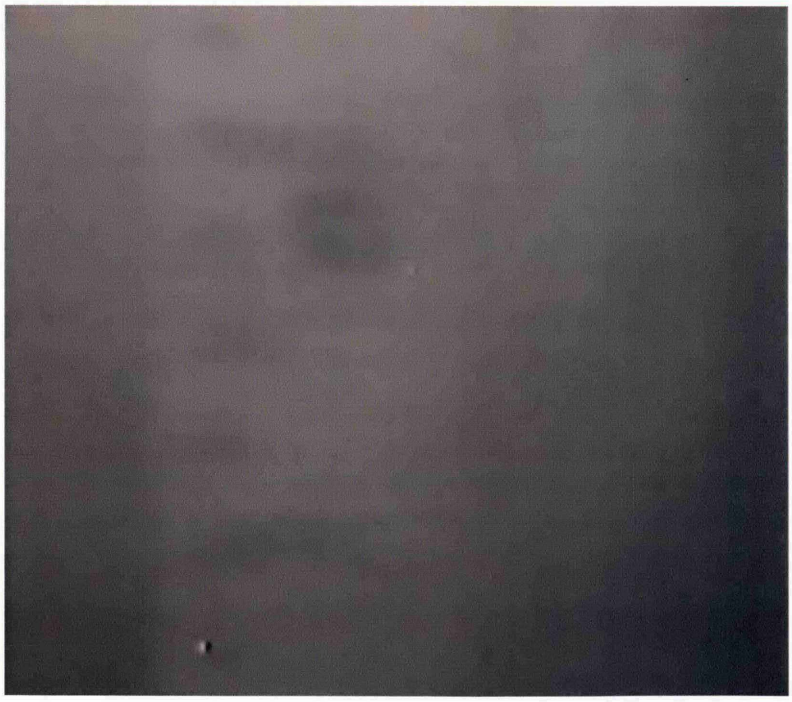


Bin 4 Top Reading: 7 inches



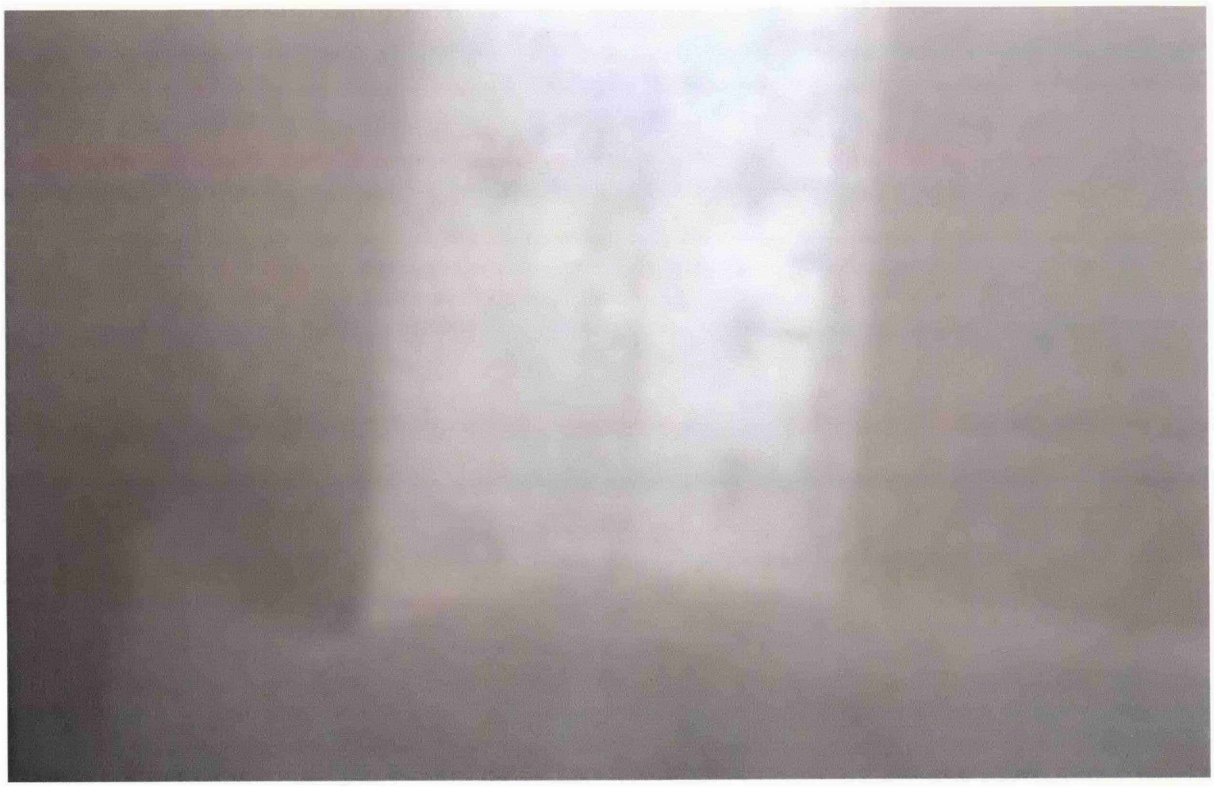
Bin 4 Bottom Reading: 5 ¼ inches (Video goes dark if camera lowered more that another quarter inch.)

Bin 5 Top Reading: 5 ½ inches

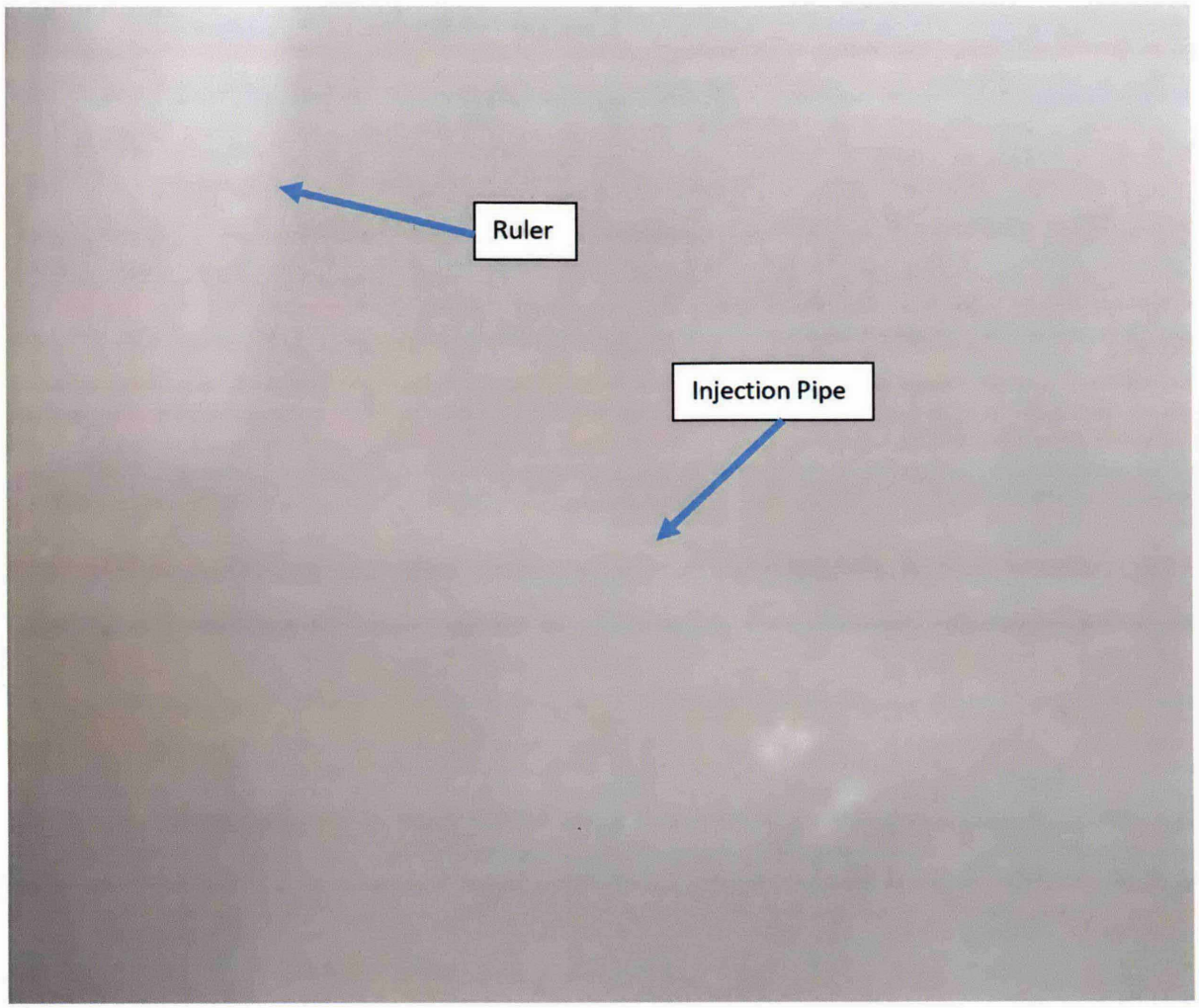


Bin 5 Bottom Reading: 7 ½ (Based on this image, 8 is the visible number. Actual sludge level is probably closer to 7 inches since the 7 ½ inch mark is visible. In video the the sludge level appears to be just below what is seen in this image.)

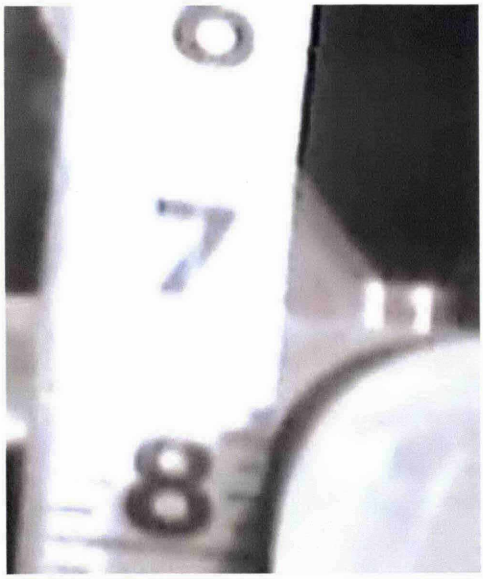
Bin 6 top reading is not needed since there is a hard reference (injection pipe) in the bottom screen shot.



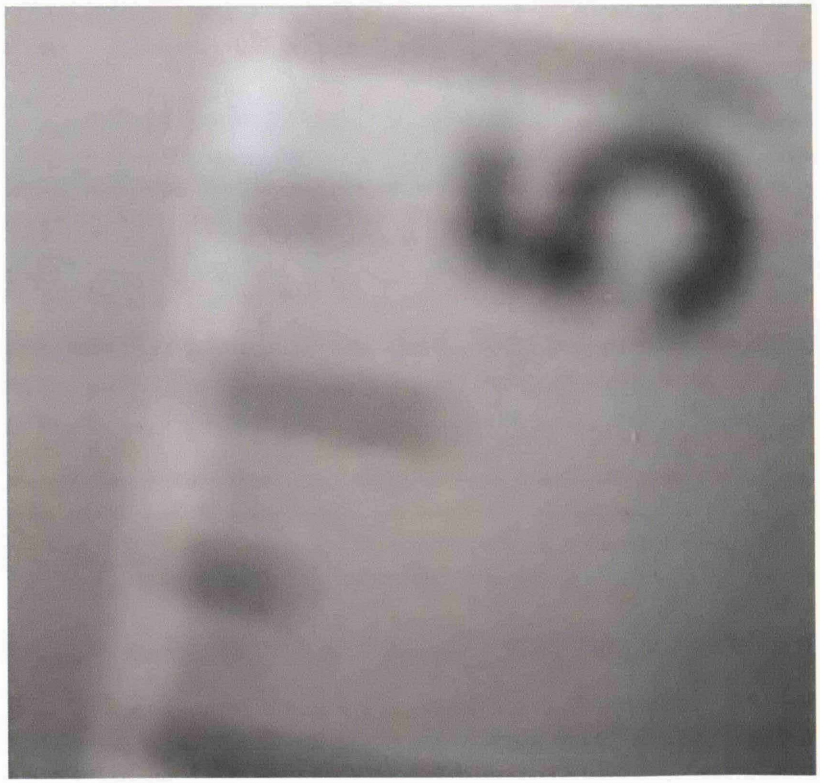
Bin 6 Bottom Reading: 3 inches at top of injection pipe.



Bin 6 Bottom: No ruler is visible under the injection pipe so it appears the sludge level is at the bottom of the pipe or 10 inch deep.



Bin 7 Top Reading: 7 inches



Bin 7 Bottom Reading: 5 ¼ inches (The video goes dark when camera goes much lower. Cannot get the 5 and the start of darkness in same capture.)

Bin 8 top reading is not needed since there is a hard reference (injection pipe) in the bottom screen shot.

Bin 8 Bottom Reading: 3 inches at top of injection pipe. The top of the pipe is 12 inches above bottom of bin. The whole pipe if visible plus some of the ruler below the pipe. See next image for more information.

Bin 8 Under Injection Pipe: The ruler is setting on the slope next to the pipe. About one inch of ruler is visible. The bottom of the image is about where sludge level is. Based on that the actual sludge level is more likely close to 3 inches below the pipe, which equates to about 7 inches of sludge. The spreadsheet has 10 inches for a sludge depth, which is conservative.

SCS-CON-260 End Point Results

RECORD COPY

1E-18-04301/Y

Engineered Container End Point Criteria Inspection

WCN-2

Table 1. EC End Point Criteria Data

SCS-CON- 260	Bin 1	Bin 2	Bin 3	Bin 4	Bin 5	Bin 6	Bin 7	Bin 8	Total
Sludge Depth (in)	8.5	13.25	7	9	9.75	10.75	13	8.5	see attached spreadsheet
Estimated Volume (gal)	2.4	7.7	2.0	2.8	3.6	4.5	7.6	4.4	37.8 see spreadsheet for add ons
OPS (initials/date)	gc 9/5/19	gc 9/5/19	gc 9/5/19	gc 9/5/19	gc 9/5/19	gc 9/5/19	gc 9/5/19	gc 9/5/19	N/A gc 9/5/19
QA (initials/date)	RJK 9/05/19	RJK 9/05/19	RJK 9/05/19	RJK 9/05/19	RJK 9/05/19	RJK 9/05/19	RJK 9/05/19	RJK 9/05/19	N/A RJK 9/05/19
PCE (initials/date)	9/5/19	9/5/19	9/5/19	9/5/19	9/5/19	9/5/19	9/5/19	9/5/19	N/A 9/05/19
DA						Total Volume remaining in EC is less than or equal to 38 gallons			Sign/Date 9/5/19
K Basin Closure Rep						Total Volume remaining in EC is less than or equal to 38 gallons			Sign/Date 9/5/19
SOM/FM						Total Volume remaining in EC is less than or equal to 38 gallons			Sign/Date 9/5/19

EC 260 End Point	BIN 1	BIN 2	BIN 3	BIN 4	BIN 5	BIN 6	BIN 7	BIN 8		Notes
Bottom ruler reading (bottom is 0) (in.)	7	11.25	5.5	7.25	7.5	9.25	11	6.5		
Bottom ruler length (in.)	24	24	24	24	24	24	24	24		
Top ruler reading (top is 0) (in.)	5.75	6.25	5.75	6	6.5	5.75	6.25	6.25		
Top ruler length (in.)	24	24	24	24	24	24	24	24		
EC depth to sludge (in.)	79.25	74.5	80.75	78.75	78	77	74.75	79.25		Based on length of measuring tool 92". See formula below.
EC depth	87.75	87.75	87.75	87.75	87.75	87.75	87.75	87.75		
Sludge depth (in)	8.5	13.25	7	9	9.75	10.75	13	8.5		
Sludge volume (gal)	2.1	7.5	1.19	2.43	3.1	4.1	7.1	2.1	29.62	
UpSlope Sludge volume (gal)	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	1.4	assume 1/16" thick on shallow EC slopes only
Walls (gal)									2.7	1/32 film on walls based on EC dimensions 146 in. length, 60 in. wide
EC cross pipes (gal)									0.12	1 in. on cross pipes pyrmids
Additional sludge masses A-H (gal)	0.1	0.04	0.62	0.16	0.31	0.27	0.31	2.1	3.91	
Conservative sludge volume	2.4	7.7	2.0	2.8	3.6	4.5	7.6	4.4	37.8	Based on Rounded sludge depths.

EC depth to sludge formula: Bottom ruler length (24") minus bottom ruler reading + Top ruler length (24") minus top ruler reading + Distance between rulers (44").

EC Depth of 87.75" derived from drawing H-1-88419, KW SRSS/SCS Sludge Container Assembly.
Sludge Depth = EC Depth minus EC depth to sludge.

Total Sludge volume from Figure 1.	29.62	
Rough estimate of 1/16 in of sludge on shallow EC slopes ~	1.4	gal
Walls	2.7	
Pipes	0.12	
8 major sludge clumps on EC ridges were observed totaling ~	3.91	gal
Remaining Sludge Estimate =	37.75	gal

D.D. Cheng 9-5-19
KJ McCracken 9/5/19
Ron Kidder 9/05/19

EC 260 Clump Volume Estimates

$A := 22.5 \cdot in^3$ $\quad A = 0.097\,gal$

$B := 9 \cdot in^3$ $\quad B = 0.039\,gal$

$C := 144 \cdot in^3$ $\quad C = 0.623\,gal$

$D := 36 \cdot in^3$ $\quad D = 0.156\,gal$

$E := 72 \cdot in^3$ $\quad E = 0.312\,gal$

$F := 64 \cdot in^3$ $\quad F = 0.277\,gal$

$G := 72 \cdot in^3$ $\quad G = 0.312\,gal$

$H := 480 \cdot in^3$ $\quad H = 2.078\,gal$

$Pipe := 30 \cdot in^3$ $\quad Pipe = 0.13\,gal$

$Total := A + B + C + D + E + F + G + H + Pipe$

$Total = 929.5\,in^3$

EC 260 Wal Film Thickness Volume Estimate

$Length := 146 \cdot in$

$Width := 60 \cdot in$

$H := 49 \cdot in$

$t := \frac{1}{32} \cdot in$

$Area := H \cdot [2 \cdot (Length + Width)]$

$Volume := Area \cdot t$

$Volume = 2.731\,gal$

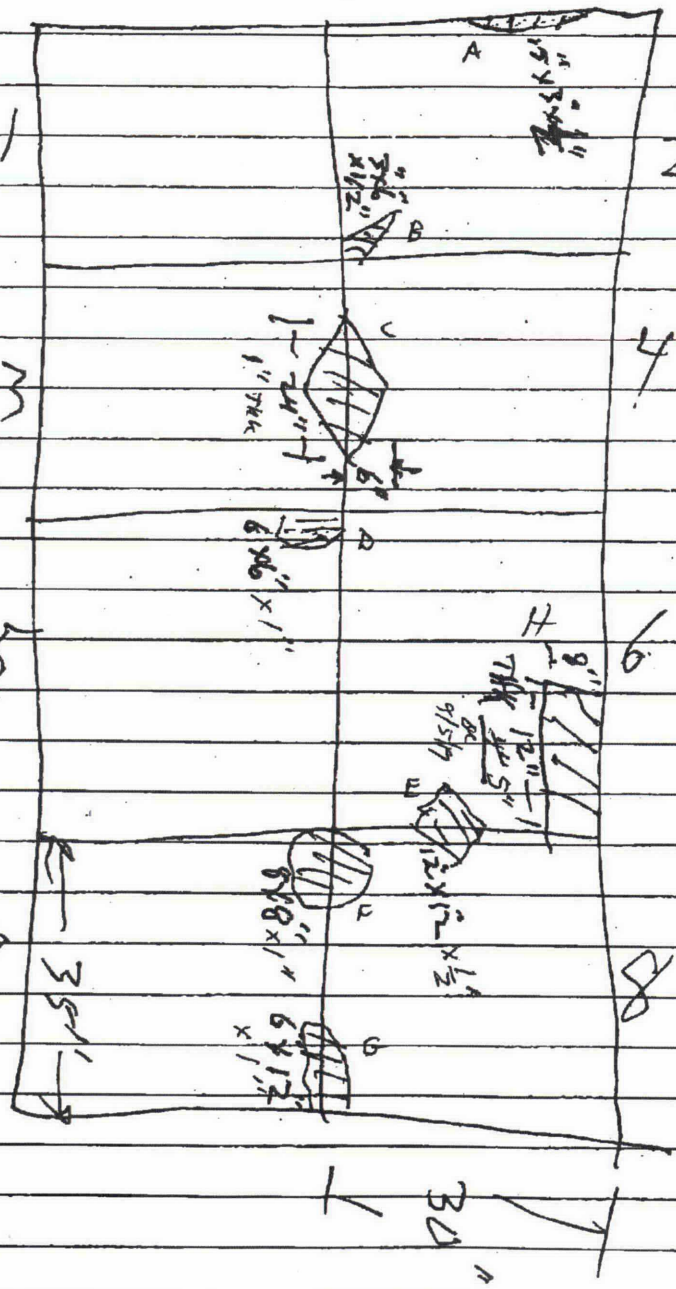
D. Craig Dilles 9-5-19

Ron Kidore RVK 9/05/19

KJM SCRACKED 9/5/19

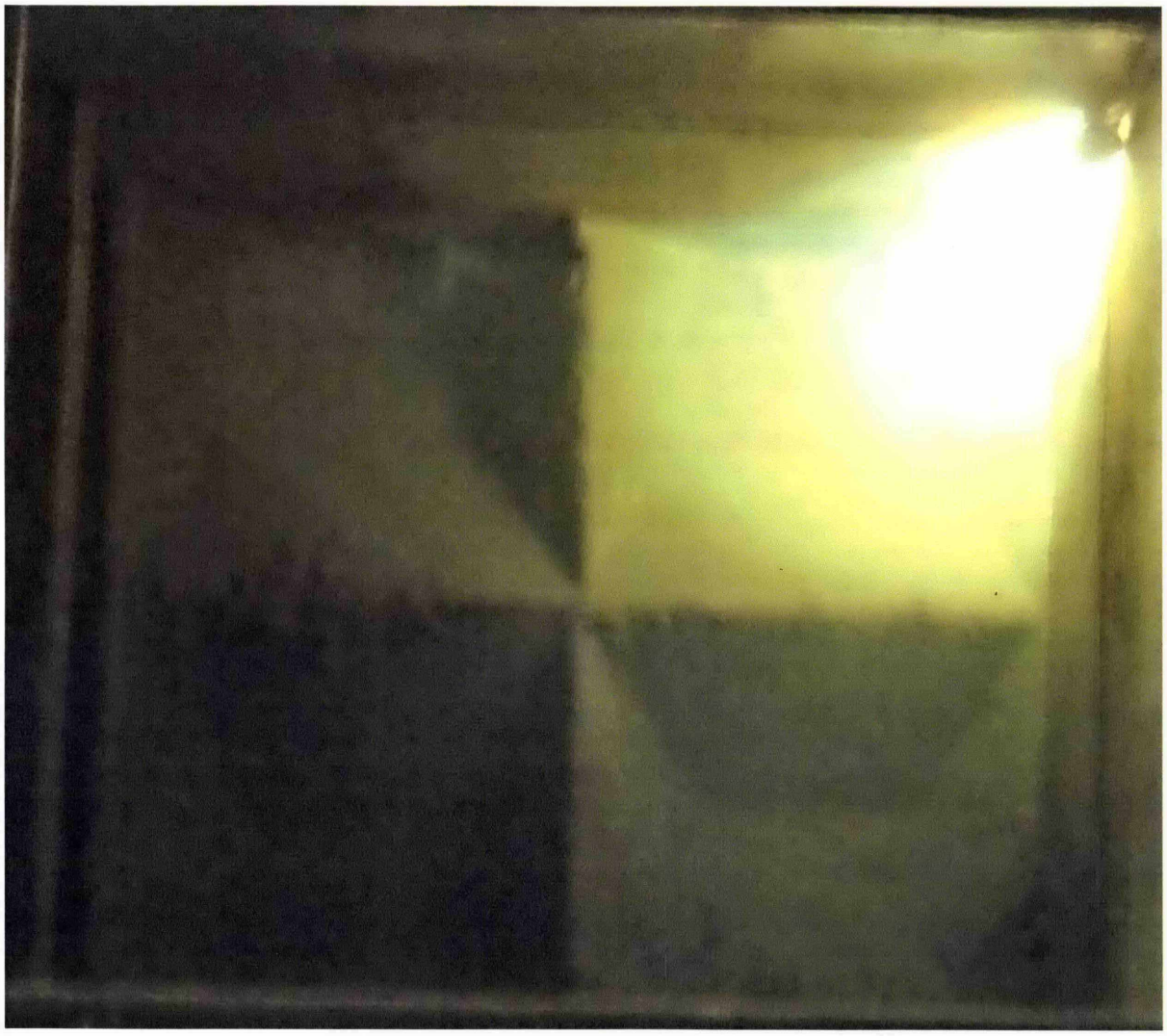
SCS-CON-260 End Point Notes
9/5/19

Top 5 3/4"	1	2	T 6 1/4"
Bottom 7"			B 11 1/4"
T 5 3/4"	3	4	T 6"
B 5 1/2"			B 7 1/4"
T 6 1/2"	5	6	T 5 3/4"
B 7 1/2" RJK 9/05/19 JR 9/5/19			B 9 1/4" RJK 9/05/19
T 6 1/4"	7	8	T 6 1/4"
B 11"			B 6 1/2"



Ron Kidder RJK 9/05/19
Don Craig DC 9/5/19

NOTE: All ruler readings listed under images are the numbers recorded in the field. The screen shots do not necessarily represent the view seen live in the field that was used for sludge level. Screen shot quality is not good due to poor quality of the original photos and videos. In addition, the screen capture software tends to degrade the image. Some images have light and contrast adjusted to bring out detail.



CON-260 North End: Clockwise from top right are Bins 1, 2, 4 and 3.

CON-260 Bin 1

Bin 1 Top Reading: 5 ¾ inches.

Bin 1 Bottom Reading: 7 inches (Disturbed sludge make level look higher, but may actually be lower than 7. Never saw the solid sludge surface.)

CON-260 Bin 2

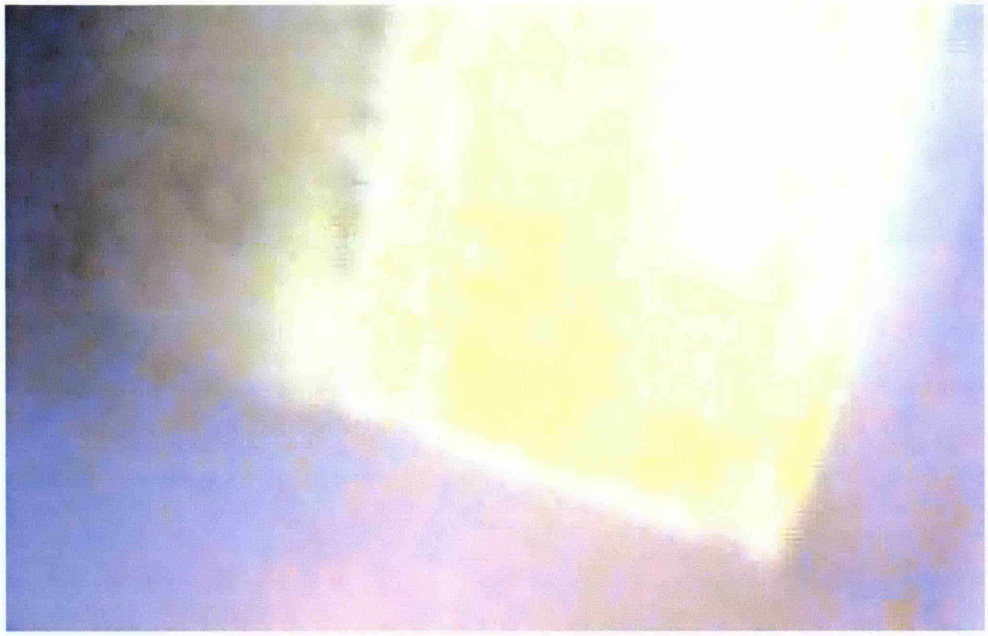
Bin 2 Top Reading: 6 ¼ inches.

Bin 2 Bottom Reading: 11 ¼ inches.

CON-260 Bin 3

CON-260 Water Injection Pipe, Bin 3

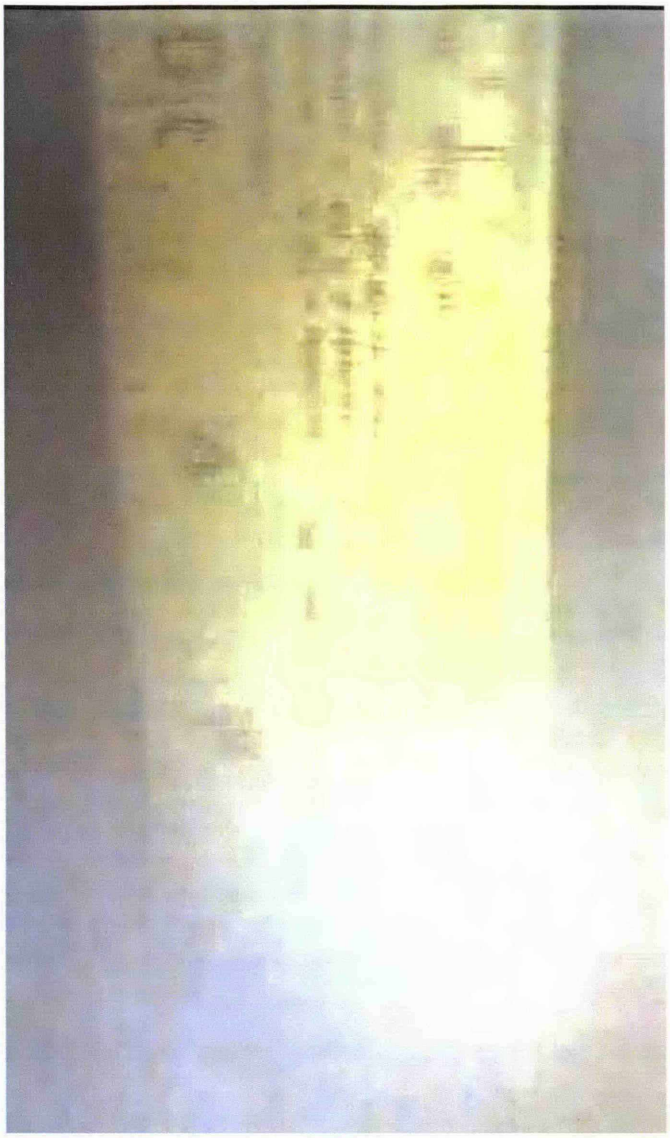
Bin 3 Top Reading: 5 ¾ inches



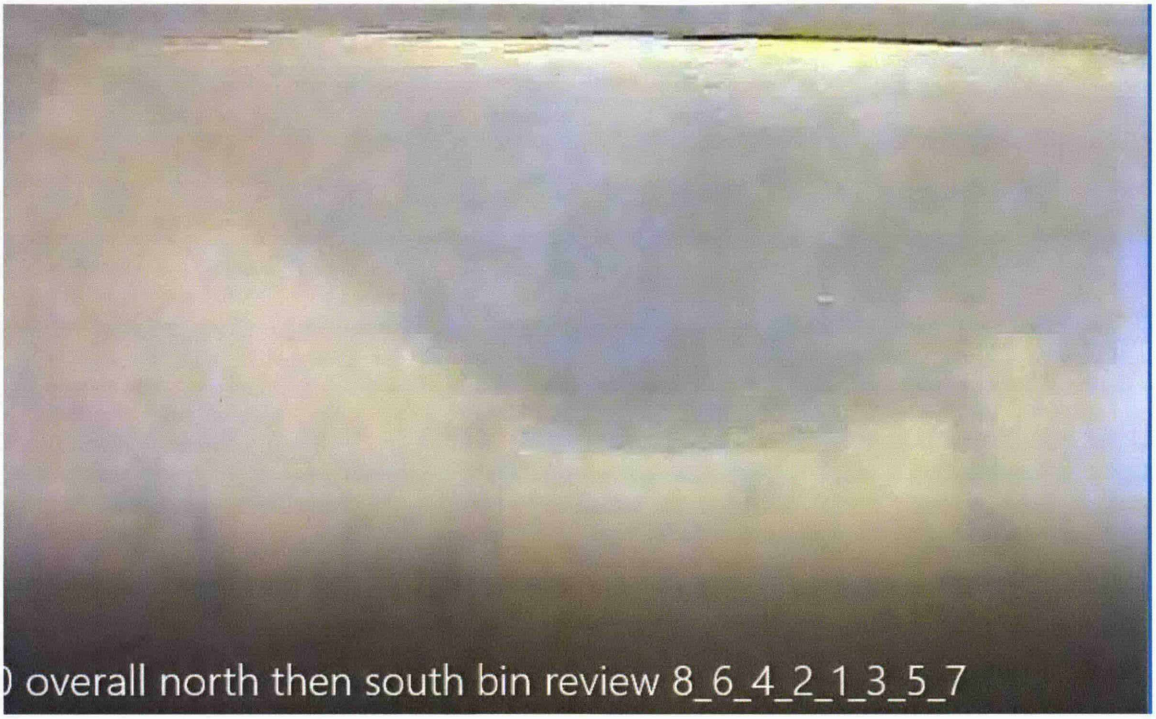
Bin 3 Bottom Reading: 5 ½ inches.

CON-260 Bin 4

Bin 4 Top Reading: 6 inches.

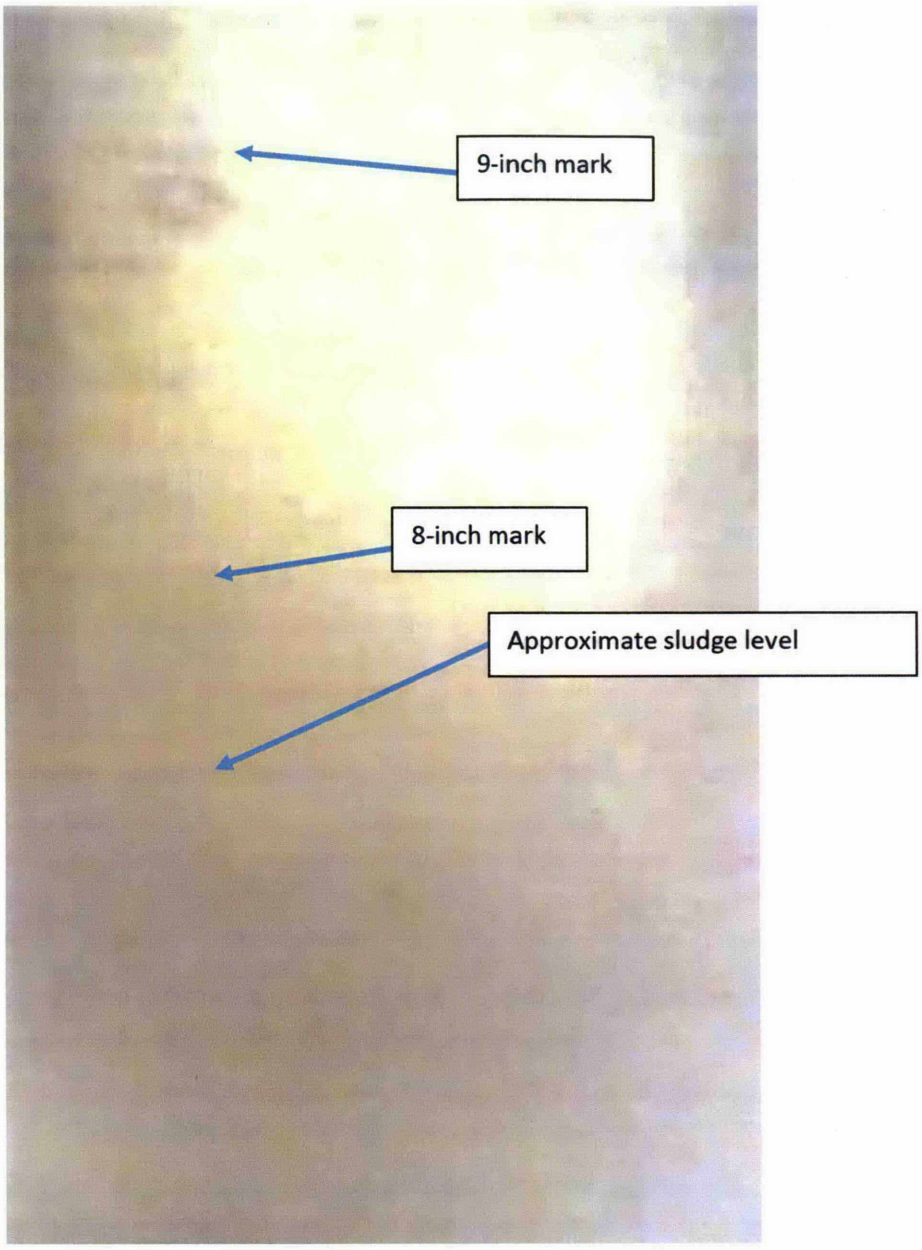


Bin 4 Bottom Reading: 7 ¼ inches (only 10 and 9 inches are legible in this capture)



CON-260 Bin 5 looking west.

Bin 5 Top Reading: 6 ½ inches.

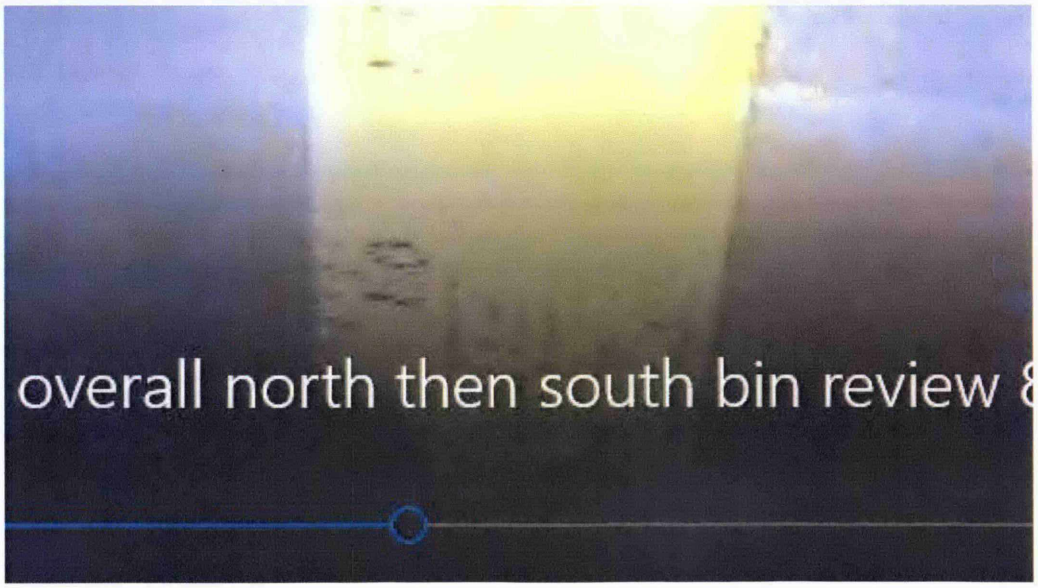


BIN 5 Bottom Reading: 7 ½ inches ()

CON-260 Bin 6

Sludge on top of and to the south of Bin 6 water injection pipe. Approximately 6 inches X 4 inches tall X 12 inches.

Bin 6 Top Reading: 5 ¾ inches



Bin 6 Bottom Reading: 9 ¼ inches.

CON-260 Bin 7 looking south west

Bin 7 looking northwest

Bin 7 Top Reading: 6 ¼ inches.

Bin 7 Bottom Reading: 11 inches.

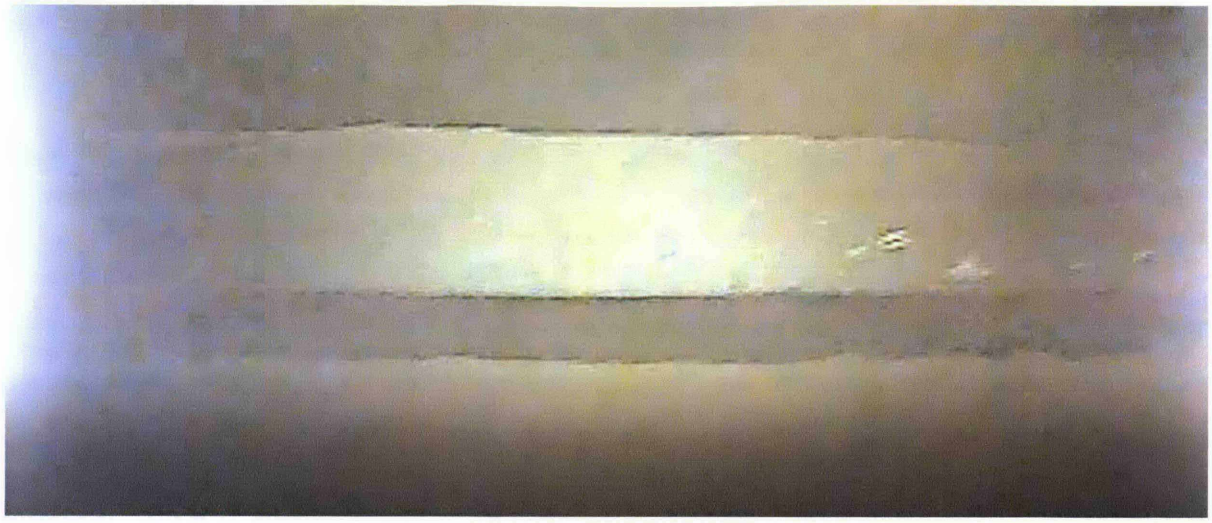
CON-260 Bin 8

Bin 8 Top Reading: 6 ¼ inches

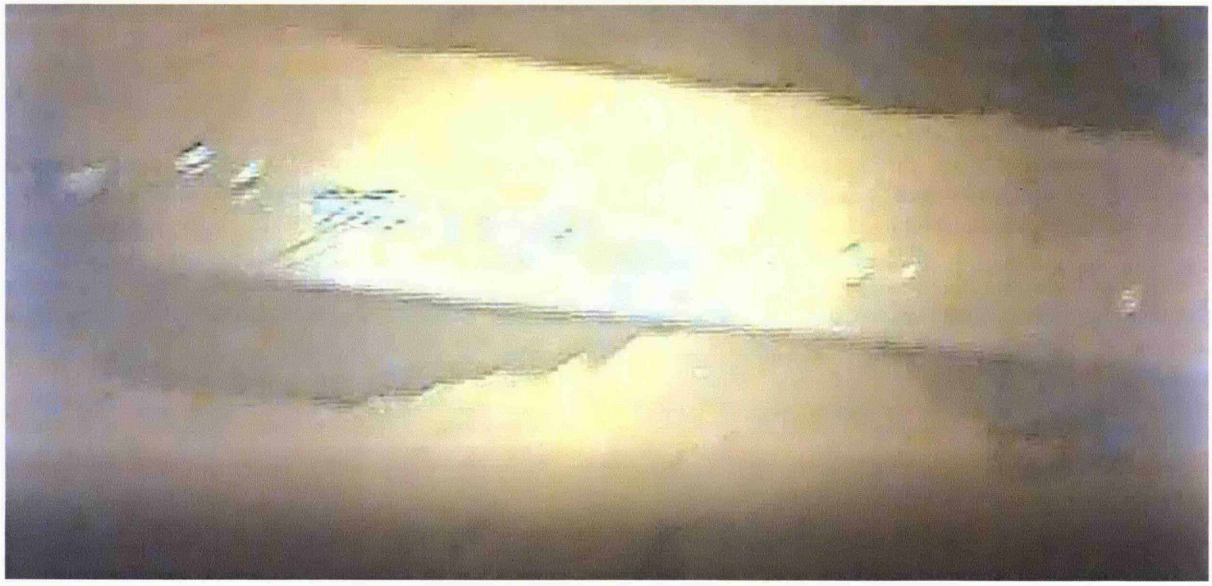
Bin 8 Bottom Reading: 6 ½ inches. (Top number is 9 inches. The 8 and 7 are visible, but not legible in the captured shots.

Sludge on ridge between Bins 3 and 4.

Sludge at intersection of Bins 1, 2, 3 and 4.



West side of pipe above ridge between north and south side of CON-260. Pipe is 2.375 inch outside diameter. Gap between the bare metal ridge and bottom of pipe is 2 inches.



Middle of pipe above ridge between north and south side of CON-260.

East side of pipe above ridge between north and south side of CON-260

Sludge at intersection of Bins 5, 6, 7 and 8.

Sludge on ridge between Bins 7 and 8 at the south wall.

Sludge on ridge between Bins 8 and 6