U.S. Department of Energy
Office of River Protection
P.O. Box 450, MSIN H6-60
Richland, Washington 99352

0073013

07-TOD-049

JUN 0 7 2007

Ms. Jane A. Hedges, Program Manager
Nuclear Waste Program
Washington State
Department of Ecology
3100 Port of Benton Blvd.
Richland, Washington 99354

Dear Ms. Hedges:

SUBMITTAL OF MILESTONE M-23-26, 241-BY-ITS1 LIQUID LEVEL ASSESSMENT REPORT, RPP-RPT-32085, REVISION 0

This letter transmits the 241-BY-ITS1 Liquid Level Assessment Report. The assessment completes the requirements for Milestone M-23-26. Additionally, with completion of this Interim Milestone, all components of Milestone M-23 have now been completed.

If you have any questions, you may contact me, or your staff may contact Delmar L. Noyes, Acting Assistant Manager for Tank Farms Project, (509) 376-5166.

Sincerely,

Shirley J. Olinger, Acting Manager
Office of River Protection

TOD:JDL

Attachment

cc: w/attach:
M. S. Spears, CH2M HILL
S. Harris, CTUIR
J. J. Lyon, Ecology
S. L. Leckband, HAB
G. Bohnee, NPT
K. Niles, ODOE
A. Conklin, WDOH
J. Martell, WDOH
R. Jim, YN
Administrative Record M-23-26
CH2M HILL Correspondence
Environmental Portal, LMSI

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Attachment
07-TOD-049

RPP-RPT-32085, 241-BY-ITS1 Liquid Level Assessment Report, Revision 0

(Consisting of 26 pages including coversheet)

241-BY-ITS1 Liquid Level Assessment Report

KJ Hull
CH2M HILL Hanford Group
Richland, WA 99352
U.S. Department of Energy Contract DE-AC27-99RL14047

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Key Words: ITS1, Liquid Level Assessment, LLA, In-tank solidification, TPA milestone M-23-26, 241-BY, Ion Exchange Column, Feed Tank, Scrub Solution Circulation Tank

Abstract: This report is a summary of the liquid level measurement and video assessment of three vessels in 241-BY-ITS1. The vessels were the ion exchange column, the feed tank (tank 2), and the scrub solution circulation tank.

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ATTACHMENT

ITS-1 LIQUID VOLUME CALCULATIONS

1.0 PURPOSE

This report documents the 241-BY-ITS-1 liquid level assessment work performed December, 2006 to meet the requirements of Hanford Federal Facility Agreement and Consent Order (Ecology et al. 1989) Milestone M-23-26 and the submitted assessment schedule in external letter 03-TOD-071, "Submittal of Milestone M-23-26 Schedule for Performing Liquid Level Assessments for 241-AX-151-CT, 241-BY-ITS2 Tank 2, 241-AX-IX, and 241-BY-ITS1 for the State of Washington Department of Ecology (Ecology) Approval".

2.0 CONCLUSIONS

The estimated liquid volume in the three 241-ITS-1 vessels are listed below based on the observations and the attached calculation:

241-BY-ITS-1 VESSEL	LIQUID VOLUME ESTIMATE (Gal.)	MEASUREMENT METHOD	MEASUREMENT DATE
Ion Exchange (IX) Column	No liquid present	Conductivity Probe, Pressure Gauge, and Video	12/12/06
Feed Tank (Tank 2)	No liquid present	Video	12/04/06
Scrub Solution Circulation Tank	347	Conductivity Probe, Sludge Weight, and Video	12/10/06

The video inspection of the 241-BY ITS1 ion exchange (IX) column, conducted on 12/06/06 and 12/08/06, did not indicate any visual evidence of significant structural problems. There is some staining on the interior and the exterior of the IX column and surface corrosion of the exterior piping below the IX column. A total of 78 gallons of the IX resin is present in the column. A pressure gauge installed at the bottom of the IX column indicated no hydrostatic head when read on 12/12/06.

The video inspection of the feed tank (also known as Tank 2), conducted on 12/04/06, did not indicate any visual evidence of significant structural problems. There is some surface discoloration on the exterior of the feed tank (particularly on the carbon steel top plate). There is some staining on the interior of the feed tank and some surface corrosion on the interior of the top.

The video inspection of the scrub solution circulation tank, conducted on 12/10/06, did not indicate any visual evidence of significant structural problems. The pit surrounding the tank was dry at the time of initial entry 11/21/06. The exterior of the tank is covered by bricks of insulation preventing an extensive examination. The top of the tank has surface corrosion. The interior view of the walls is obstructed by an array of cooling coils. The liquid present in the tank is clear and allowed observation of all of the interior pipe coils to the bottom of the tank. A

thin layer of sediment is visible on the tank bottom. There is some staining on the interior of the scrub solution circulation tank.

3.0 BACKGROUND

The Hanford Federal Facility Agreement and Consent Order Milestone M-23-26 states:

"Submit to Ecology as a primary document a schedule for performing liquid level assessments for 241-AX-151-CT, 241-BY-ITS2 Tank 2, 241-AX-IX, 241-BY-ITS1. Assessments will include liquid level measurements using a manual tape or more accurate method, volume estimates, and a video inspection of the tanks and surrounding vaults sufficient to determine the waste is being stored in a manner protective of human health and the environment.

The schedule shall establish dates for all assessments of no later than December 31, 2006."

The schedule required by milestone M-23-26 was submitted September 17, 2003 (03-TOD-071). The schedule included inactive Waste Site Liquid Level and Video Assessment Plan for HFFACO Milestone 23-26. The plan described the following 241-BY-ITS-1 deliverable:

"As a flat bottom tank, any liquid remaining in the scrub solution circulation tank should be measurable. Due to the location of the taps in the ion exchange column, any liquid in the column should also be measurable. Tank 2 levels and corresponding volumes will be assessed in excess of 11 gallons. External photos or video will be provided for the ion exchange column, the ion exchange feed tank, and the scrub solution circulation tank. Interior video of the ion exchange column will be dependent on the presence of the exchange media. "

4.0 ITS-1 FACILITY DESCRIPTION

The in-tank solidification system number 1 (241-BY-ITS1) is located within the BY-Tank Farm of the Hanford Site 200 East area. This facility was used to concentrate the tank waste by evaporating the contents of tank 241-BY-102. This was achieved by circulating heated air through the waste and condensing the off gas. The facility was constructed in the late 1950s and operated through the mid 1970s. Although portions of the equipment and ducting have been removed, the bulk of the off-gas equipment remains. The facility is constructed primarily above ground with some underground components.

This effort assessed the liquid levels in three of the vessels in the facility (the IX column, the IX feed tank and the scrub solution circulation tank). The IX column is 18 inches in diameter and 9 feet high per H-2-33481. It is shielded inside a 5 foot diameter (ID), 10 foot high reinforced concrete pipe and sits atop a 6 foot 6 inch square, 6 foot 8 inch tall concrete structure per H-2-33483. The feed tank (Tank 2) is 5 feet in diameter and 4 foot 6 inches tall per H-2-33476 with a capacity of approximately 600 gallons. The feed tank (Tank 2) sits above grade on a concrete

slab. The scrub solution circulation tank has a capacity of approximately 600 gallons. The scrub solution tank is located below grade in a 10 foot by 7 foot 6 inch by 5 foot 10 inches deep concrete pit. The oblong scrub solution tank is 39 inches wide by 7 feet in long by 4 feet tall per H-2-33478 and H-2-50260. Figure 4-1 is a graphical representation of 241-BY-ITS1 system.

5.0 VIDEO INSPECTION

The video inspection of the ITS-1 structures were performed individually and compiled together on one recording DVDID-11016, 241-BY-ITS-1 Liquid Level Assessment 12/18/06.

The IX column exterior was viewed through the access hatch at the top of the IX structure (Figure 5-1) and through the sliding door at the base. The still from the video of the top of the IX column inside the IX structure is shown on Figure 5-2. The still photograph shows the ball valve assembly in the middle and pipe lines to the feed tank and the drain. An abandoned water hose is visible draped across the top of the IX column. Figure 5-3 depicts the bottom of the IX column. The IX column paint is in very good condition. There is surface corrosion on the piping below the IX column particularly the pipe runs to and through the concrete structure walls. Access to the interior of the IX column was made through the flange and 3" ball valve at the top of the IX column. Figure 5-4 is a still photograph of the interior of the IX column. The IX resin is present in the IX column. Liquid was not observed in the IX column. The video inspection of the IX column did not indicate any visual evidence of significant structural problems. There is some staining on the interior and the exterior of the IX column and surface corrosion of the exterior piping.

The ITS-1 Feed Tank (Tank 2) is located above grade south of the IX column (refer to Figures 5-5 and 5-6). Access to the interior of the feed tank was made by removing the two inch flange on top of the tank and lowering the camera (interior is shown on Figure 5-7). The vast majority of the floor was clearly visible and there was no liquid present in the tank. Dip tubes and the temperature probe are visible in the video. Tank interior features such as the 1" drain line and the pump suction at the bottom of the tank provide reference points. The majority of the tank bottom is visible although there are some solids in a drift by the pump suction line. Stains are present on the interior of the feed tank and some dried crystals on walls and roof of the tank.

The scrub solution circulation tank is located below grade in a pit at tank 241-BY-101 (refer to Figure 5-8). The pit cover was removed to allow access to the tank. The pit was dry when the cover was removed (see Figure 5-9). The exterior sides of the tank are insulated with asbestos bricks which limited exterior inspection. The tank was accessed by removing the blind flange on the 8" raised pump port. Liquid is present in the tank, the liquid is clear which allows visibility of the pipe coils and the tank bottom. There is some staining on the interior of the scrub solution circulation tank pipe coils as shown on Figure 5-10. Dip tubes can be seen extending into the liquid. There is a minor film of sediment and an agitator impeller visible on the floor of the tank.

6.0 LIQUID LEVEL MEASUREMENT

A liquid level measurement was made by using the conductivity probe in 241-BY-ITS1 IX column. The conductivity probe showed no liquid was present on the resin surface. In addition, pressure gauge PI-5 was replaced and a reading made to check hydrostatic head. The gauge reads 0 inches of H^2O pressure when open to bottom of the IX column therefore the column has no measurable liquid.

The video indicated that the feed tank was empty based on the dry floor visibility. Therefore no measurement was necessary for liquid.

A liquid level measurement was made by using the conductivity probe and a sludge weight in 241-BY-ITS1 scrub solution circulation tank. No sludge accumulation was visible in the tank and only a minor amount of sediment was observed. The difference in the readings of the two probes resulted in 347 gallons of liquid measured in the tank.

Figure 4-1 241-BY-ITS1 Components

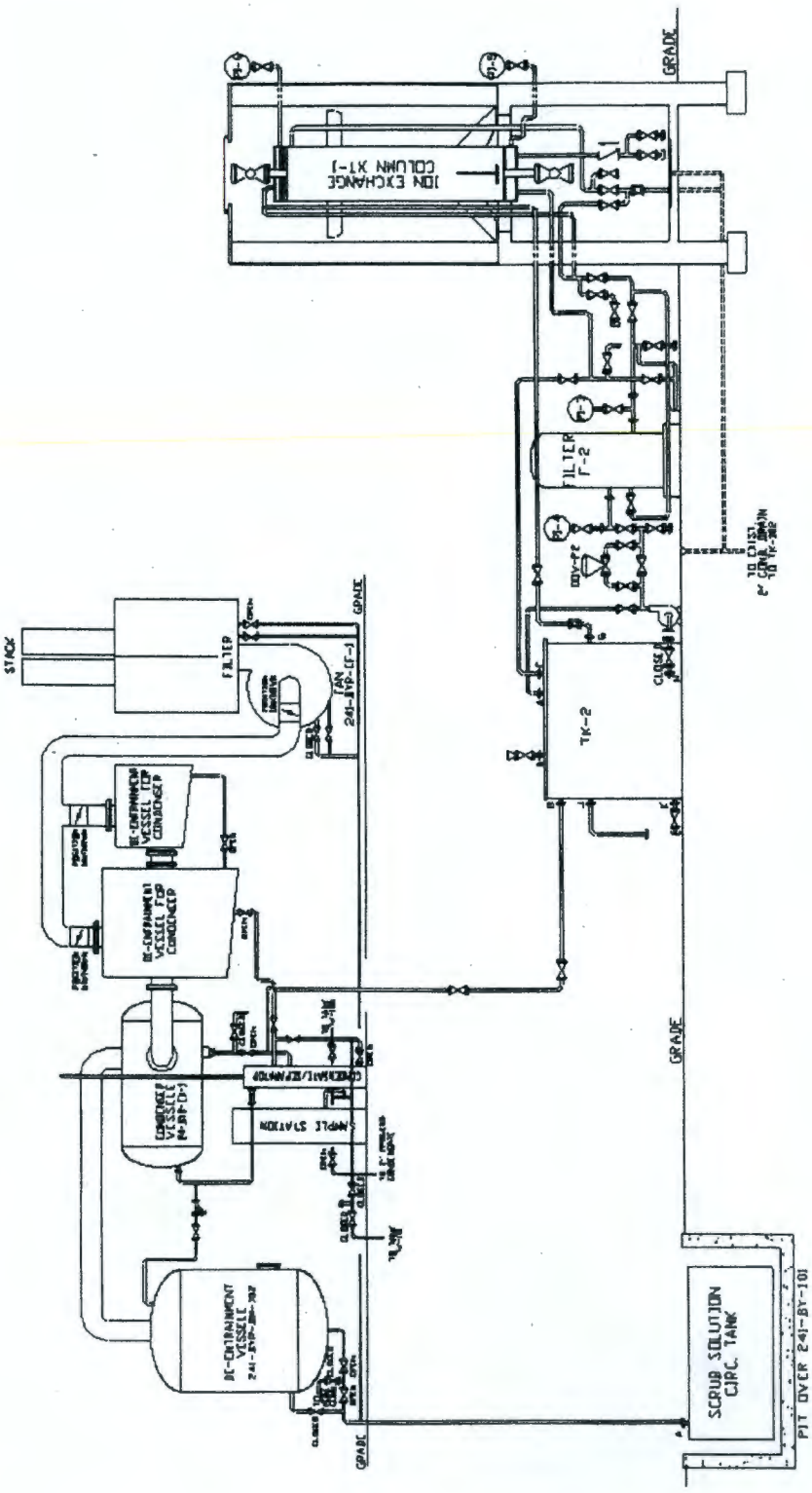


Figure 5-1 241-BY-ITS1 Exterior of IX Structure

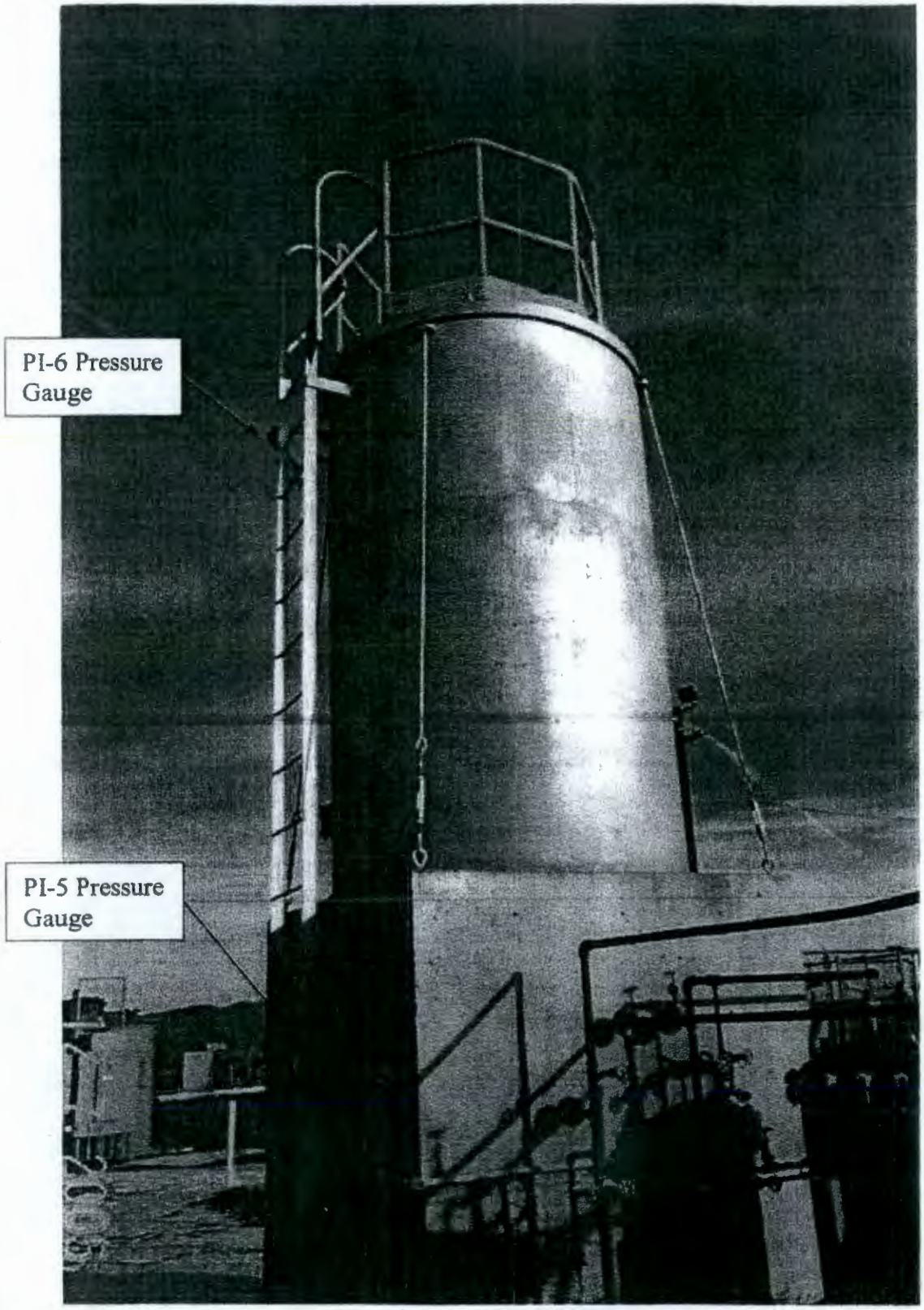
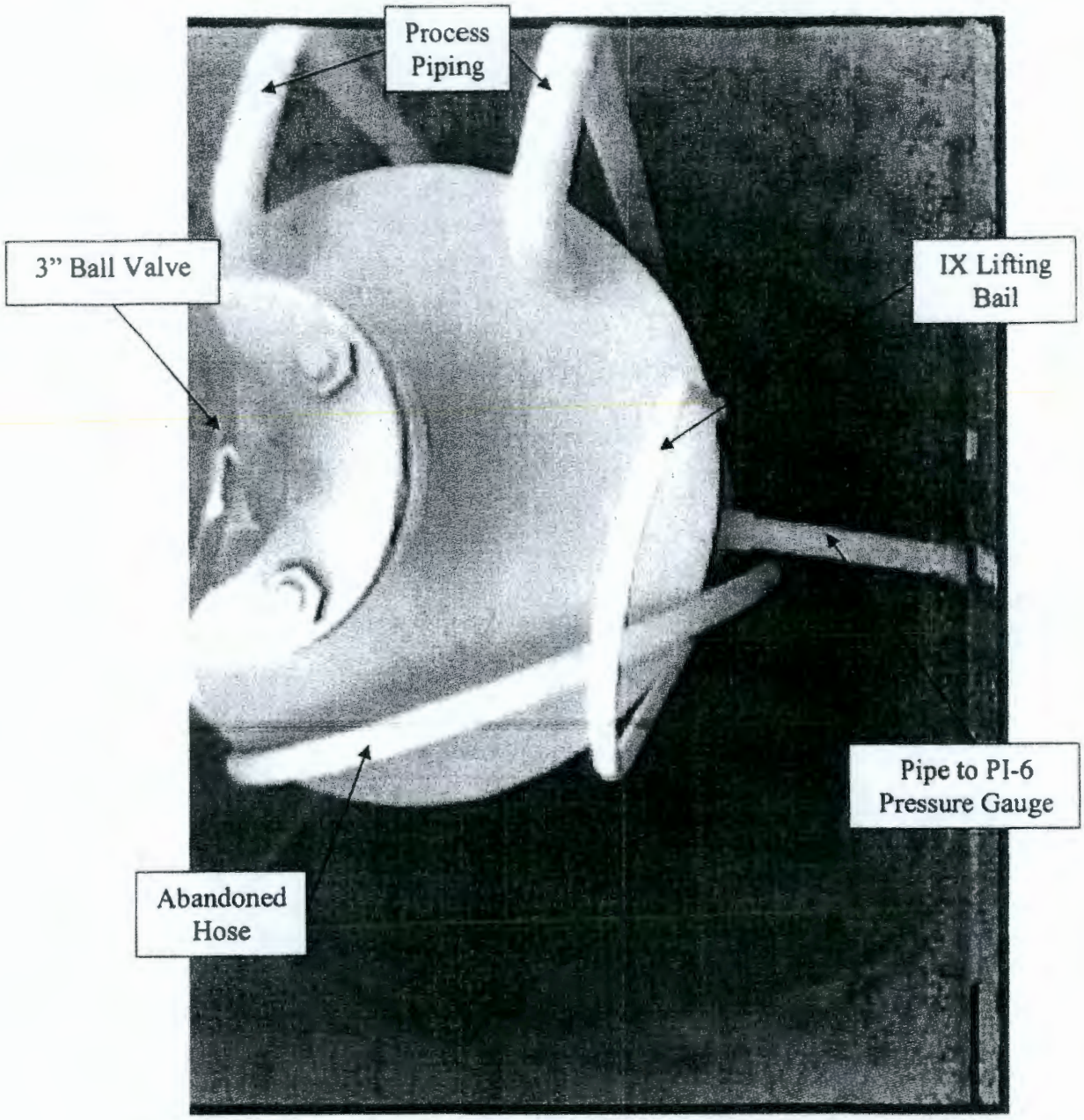
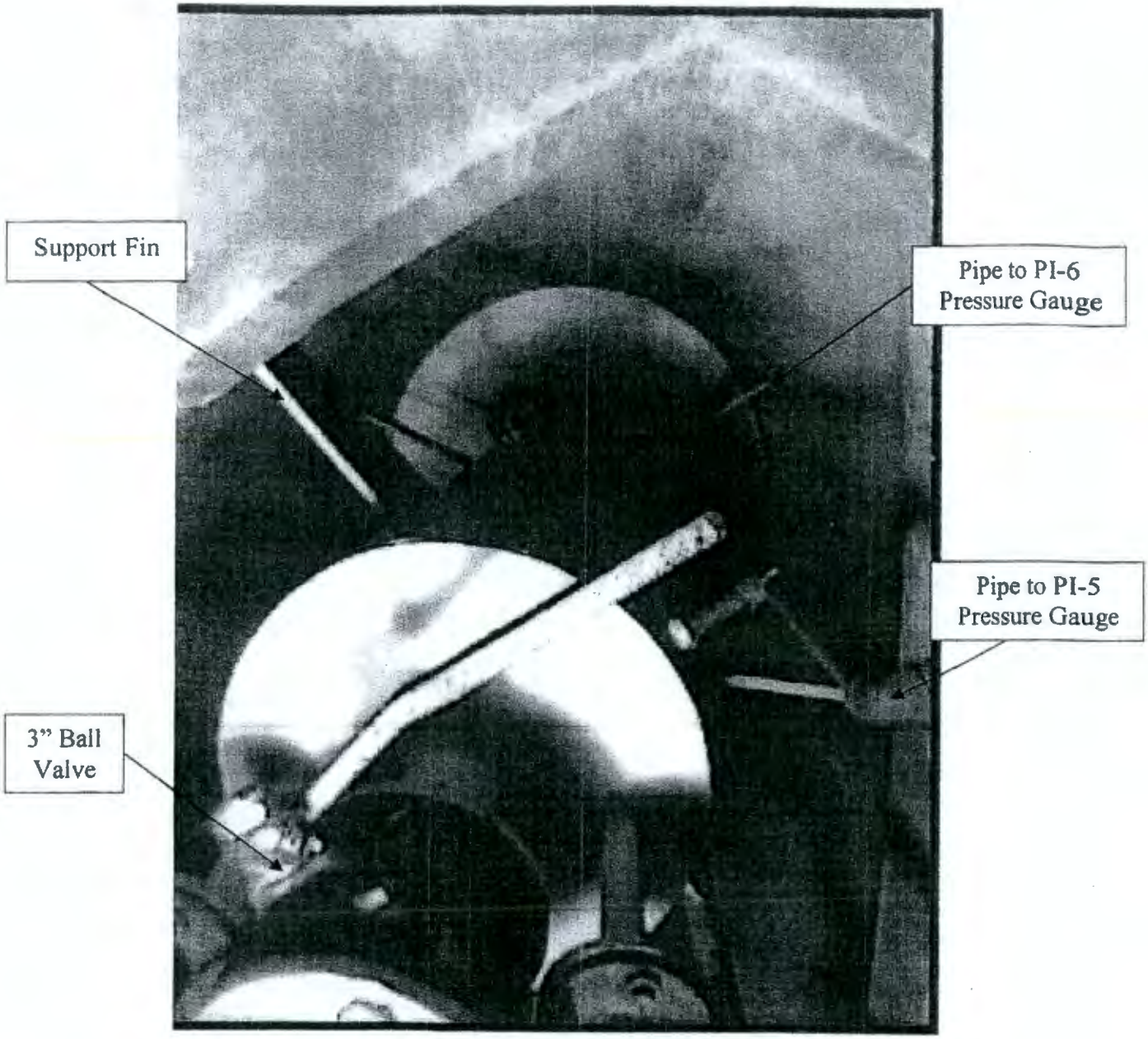


Figure 5-2 241-BY-ITS1 Top of IX Column Exterior Inside IX Structure



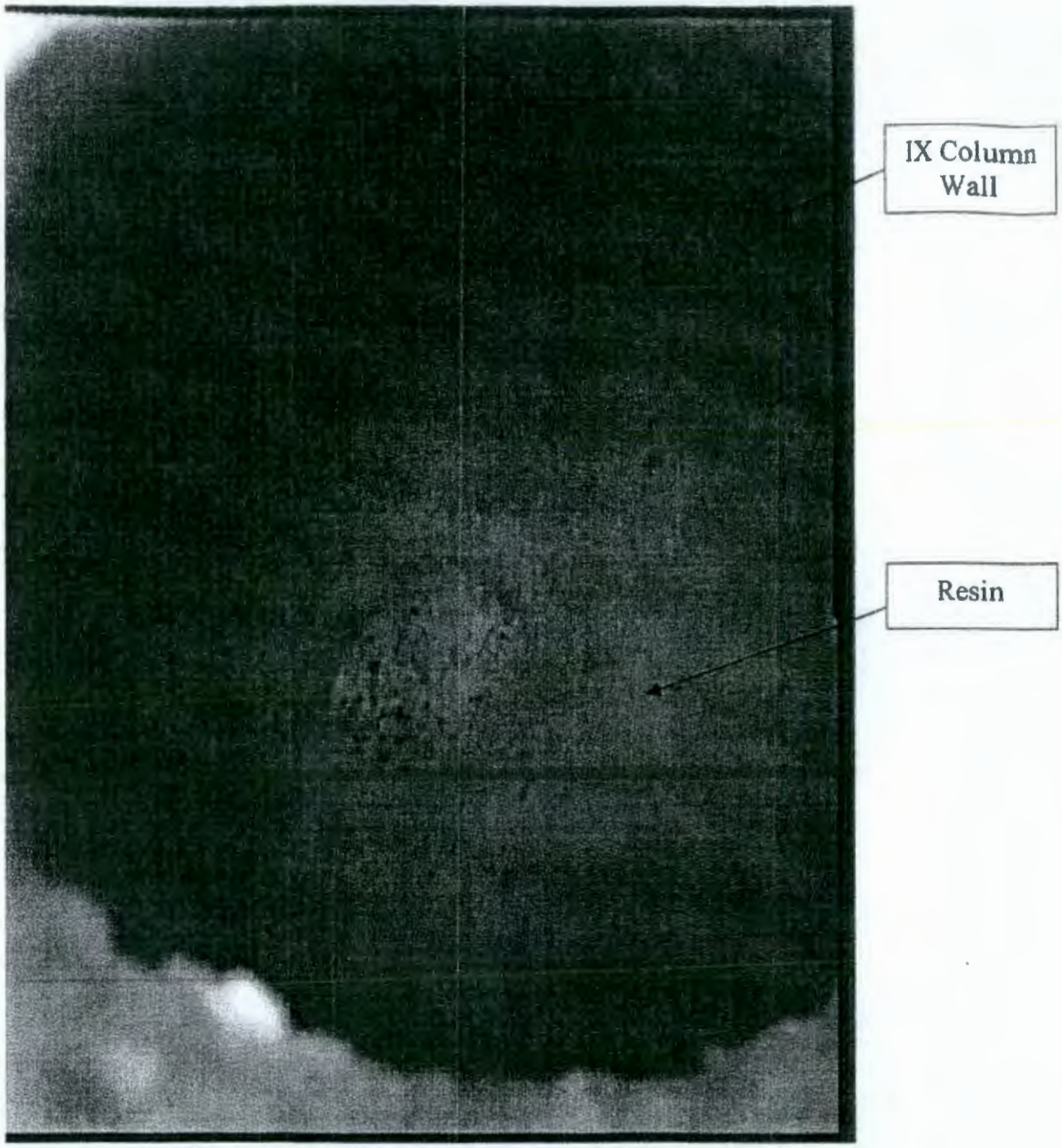
(Photo captured from video, best available copy)

Figure 5-3 241-BY-ITS1 Bottom of IX Column Exterior Inside IX Structure



(Photo captured from video, best available copy)

Figure 5-4 241-BY-ITS1 Top of IX Column Interior



(Photo captured from video, best available copy)

Figure 5-5 241-BY-ITS1 Feed Tank (Tank 2) Top Exterior

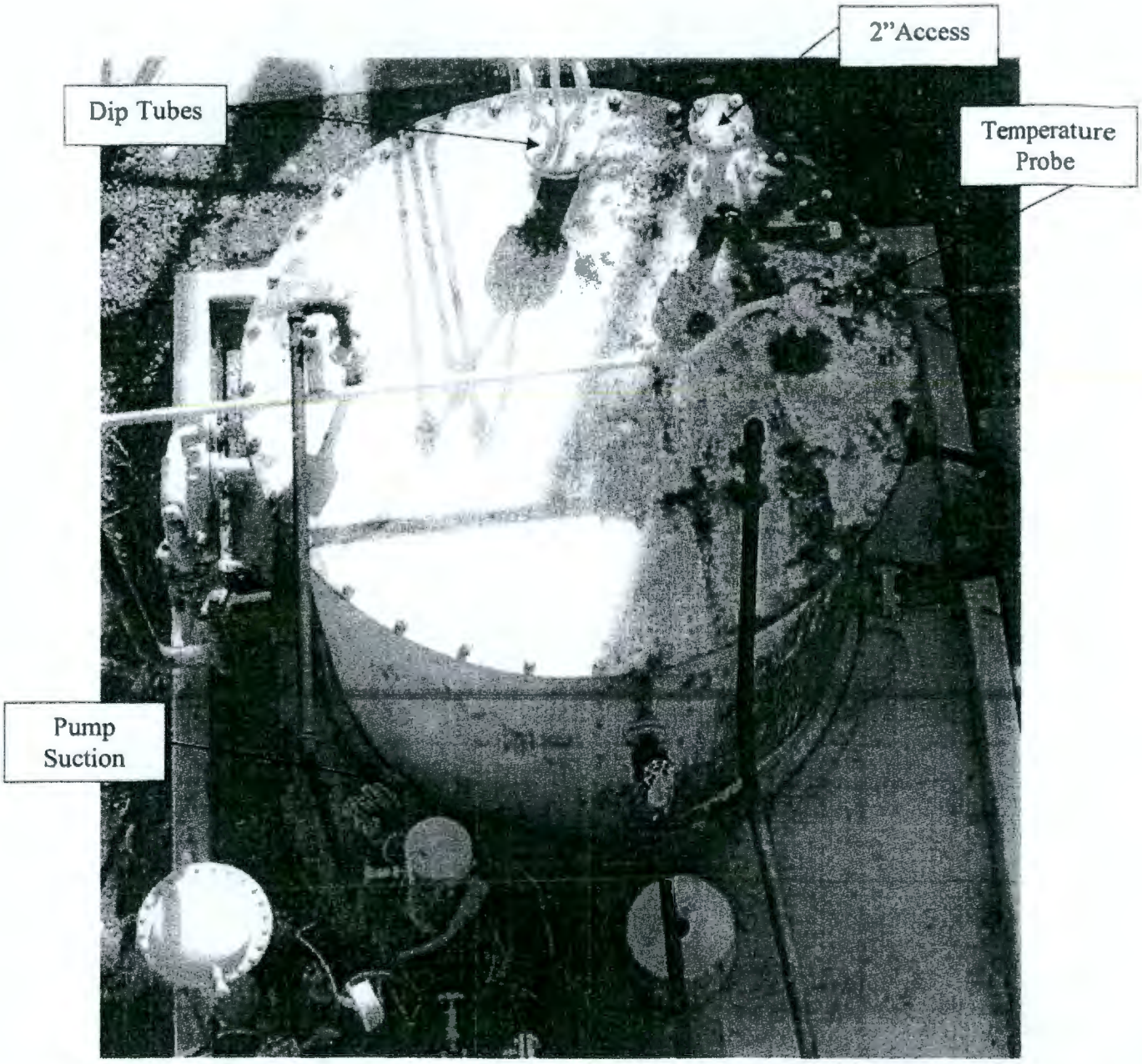


Figure 5-6 241-BY-ITS1 Feed Tank (Tank 2) Side Exterior

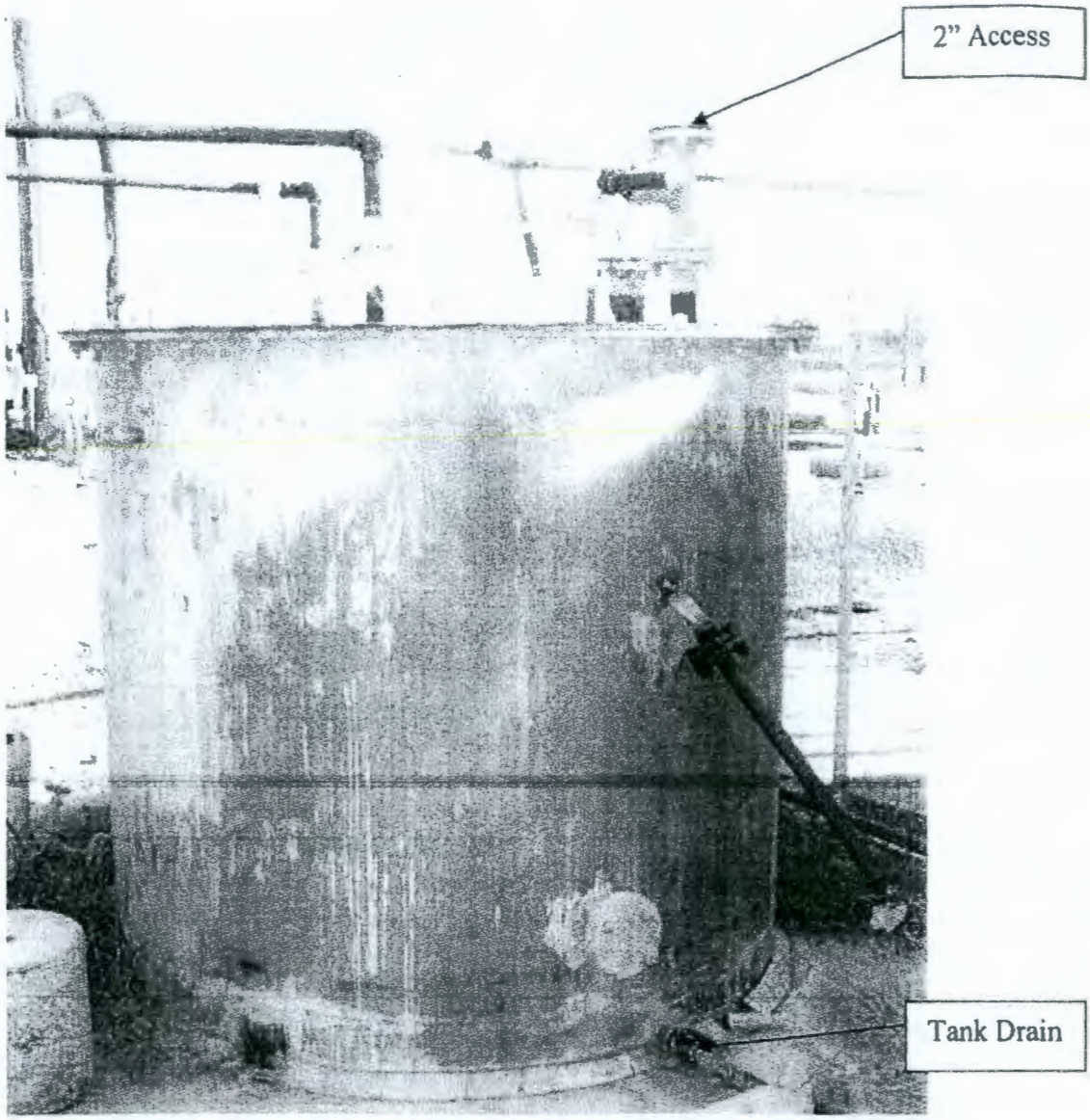
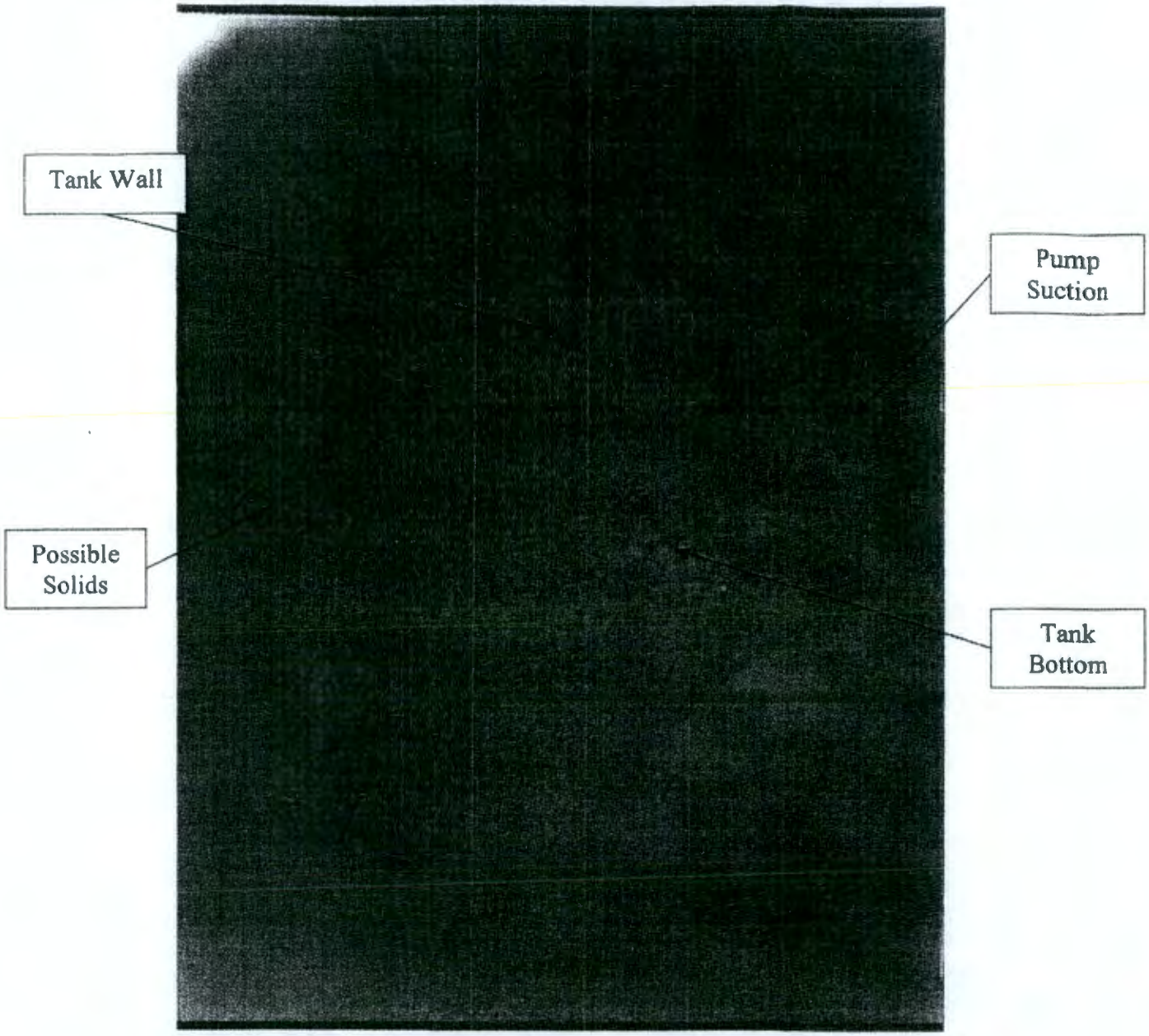


Figure 5-7 241-BY-ITS1 Feed Tank (Tank 2) Interior



(Photo captured from video, best available copy)

Figure 5-8 241-BY-ITS1 Scrub Solution Circulation Tank Pit Exterior

Figure 5-9 241-BY-ITS1 Scrub Solution Circulation Tank Exterior

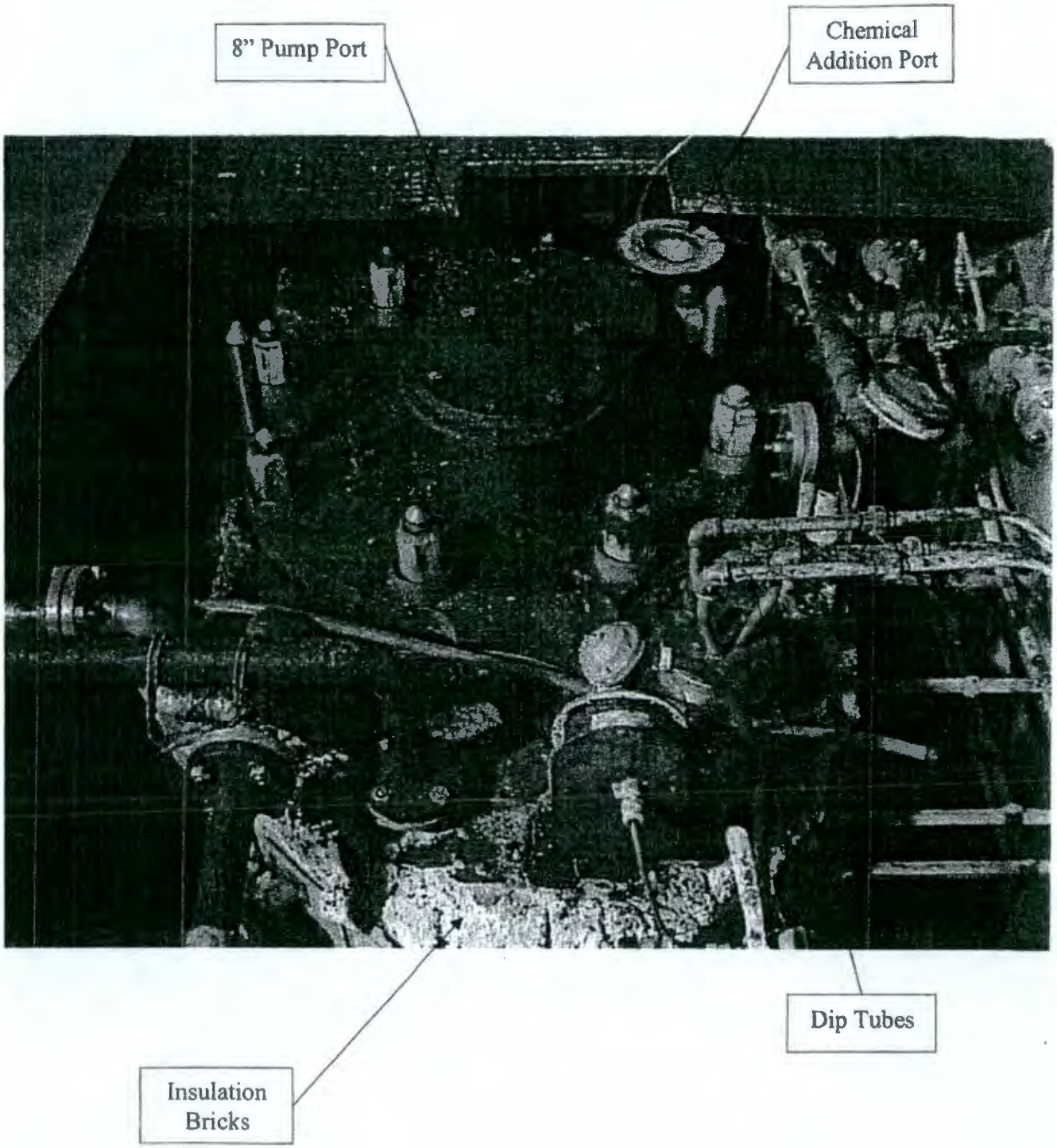
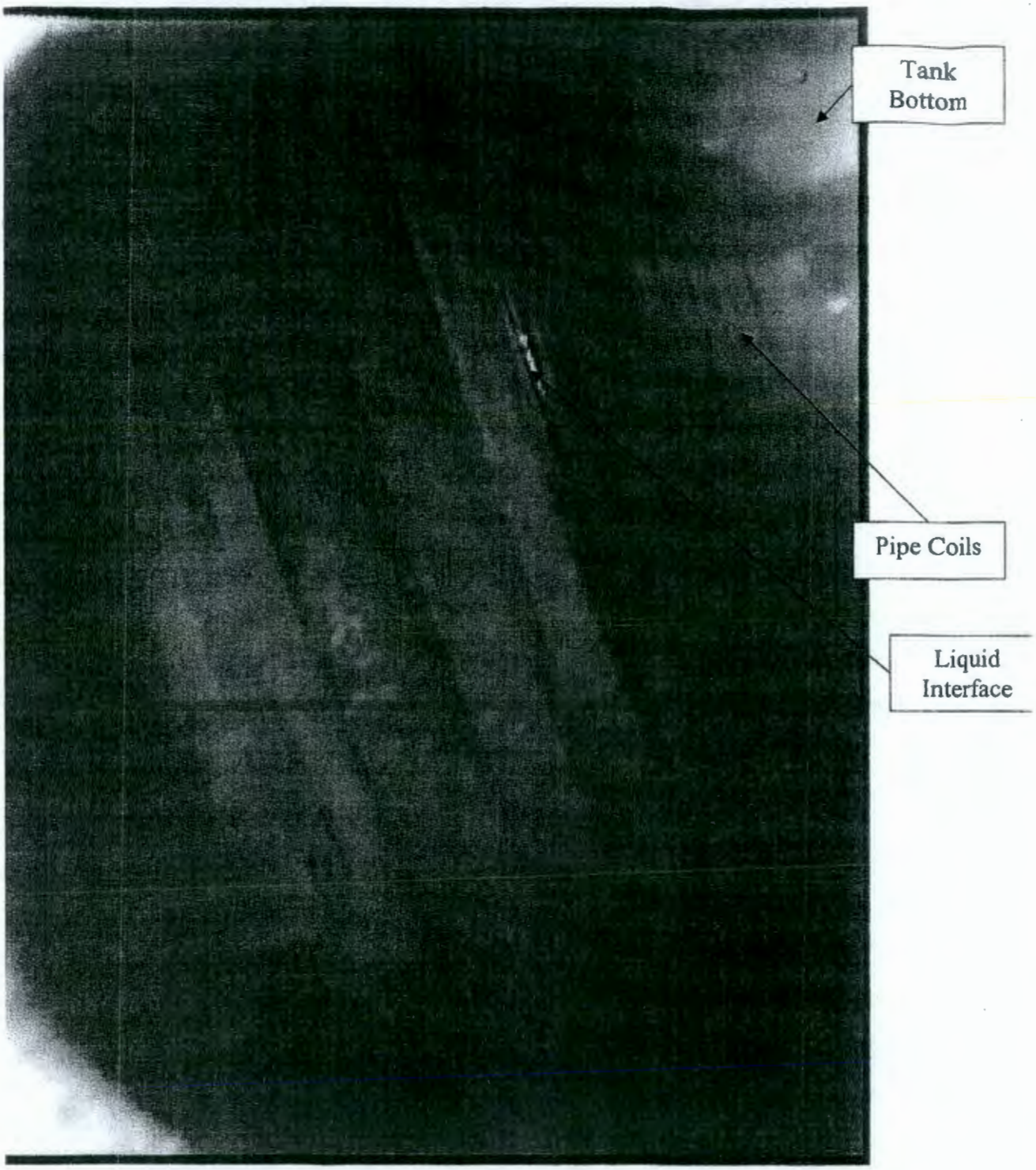
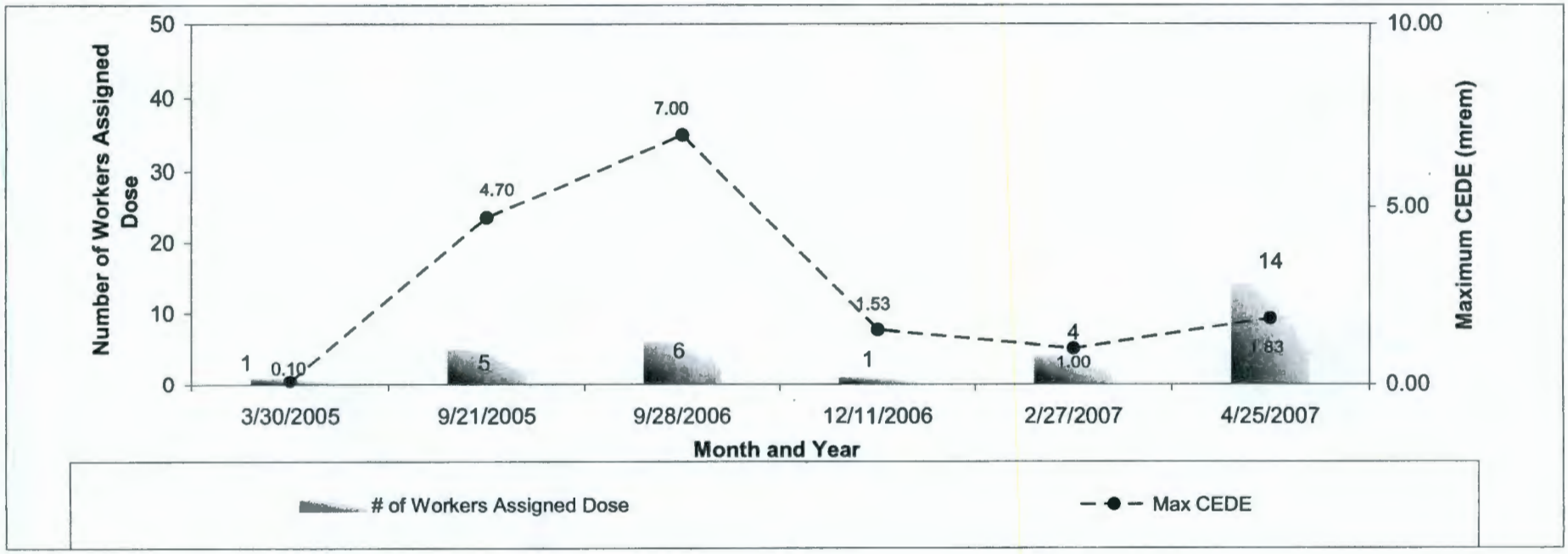


Figure 5-10 241-BY-ITS1 Scrub Solution Circulation Tank Interior



(Photo captured from video, best available copy)

Radiological Control - Functional Area
Unplanned Internal Dose Assignments
Jun 1, 2006 - May 31, 2007



Definition

This chart represents the number of events resulting in the Assignment of Unplanned Internal Dose, including the number of individuals to whom dose was assigned.

COMMENTS:
We experience a suspect intake event about once per quarter.

Analysis/Action

March 30, 2005 ATS/222-S: Floor contamination event at 222-S Counting Room. One worker assigned dose.
Worker 1 = .10 mrem

September 21, 2005 CO/Tank C-202: Workers moving hose lines associated with mobile retrieval system. Five workers assigned dose.
Worker 1 = .88 mrem; Worker 2 = 4.7 mrem; Worker 3 = .79 mrem; Worker 4 = .25 mrem; Worker 5 = .29 mrem

September 28, 2006 ATS/219-S: Workers in 10 DAC (Am;Pu) atmosphere at 219-S building without respriatory protection. Six workers assigned dose.
Worker 1 = 4.0 mrem; Worker 2 = 1.0 mrem; Worker 3 = 7.0 mrem; Worker 4 = 6.0 mrem; Worker 5 = 2.0 mrem; Worker 6 = 3.0 mrem

December 11, 2006 ATS/222-S: Acid digest activities conducted in Room 4B at 222-S caused alpha airborne activity >0.1 DAC. One worker assigned dose.
Worker 1 = 1.53 mrem

February 27, 2007 CO/272-S: Glovebag seam ruptured in 272-S Building causing alpha airborne activity >0.1 DAC. Four workers assigned dose.
Worker 1 = 1.0 mrem; Worker 2 = 1.0 mrem; Worker 3 = 1.0 mrem; Worker 4 = 1.0 mrem

April 25, 2007 CO/C-109 Sluice Box: Workers exposed to 0.36 Working Level (WL) thoron daughters. Fourteen workers assigned dose.
Workers 1 - 12 = 1.83 mrem; Workers 13 & 14 = 0.5 mrem

7.0 REFERENCES

Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order – Tri-Party Agreement*, 2 vols., as amended, State of Washington Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

03-TOD-071, 2003, "Submittal of Milestone M-23-26 Schedule for Performing Liquid Level Assessments for 241-AX-151-CT, 241-BY-ITS2 Tank 2, 241-AX-IX, and 241-BY-ITS1 for the State of Washington Department of Ecology (Ecology) Approval", external letter Roy J. Schepens to Michael A. Wilson, U.S. Department of Energy, Office of River Protection, Richland Washington.

DVDID-11016, 2006, *241-BY-ITS-1 Liquid Level Assessment 12/18/06*, CH2M Hill Hanford Group, Inc., Richland, Washington

H-2-33476, 1967, *Feed Tank 2 Modifications*, U.S. Atomic Energy Commission, Richland Operation Office, Richland, Washington.

H-2-33478, 1967, *Solution Hold-up Tank Modifications*, U.S. Atomic Energy Commission, Richland Operation Office, Richland, Washington.

H-2-33479, 1967, *ITS No. 1 Circulating Scrubbing System Prototype*, U.S. Atomic Energy Commission, Richland Operation Office, Richland, Washington.

H-2-33481, 1967, *Ion Exchange Column Assembly & Details*, U.S. Atomic Energy Commission, Richland Operation Office, Richland, Washington.

H-2-33482, 1967, *Piping Plan & Details*, U.S. Atomic Energy Commission, Richland Operation Office, Richland, Washington.

H-2-33483, 1967, *Struct. Plan & Details*, U.S. Atomic Energy Commission, Richland Operation Office, Richland, Washington.

H-2-33484, 1967, *Structural Details*, U.S. Atomic Energy Commission, Richland Operation Office, Richland, Washington.

H-2-50260, 1954, *Continuous Concentrator Cooler Assembly-Sections-Details and Cell Orientation*, U.S. Atomic Energy Commission, Hanford Atomic Products Operation, Richland, Washington.

ATTACHMENT

CATCH TANK 241-AX-151-CT LIQUID VOLUME CALCULATION

Calculation Reviewed: 241-BY-ITS1 Liquid Volume Calculation

Scope of Review: ATTACHMENT TO RPP-RPT-32085 R0
(e.g., document section or portion of calculation)

Engineer/Analyst: K. J. Hull Date: 12/18/06

Organizational Manager: D. G. Baide Date: 12/18/06

This document consists of 6 pages and the following attachments (if applicable):
N/A

Yes	No	NA*		
[✓]	[]	[]	1.	Analytical and technical approaches and results are reasonable and appropriate.
[✓]	[]	[]	2.	Necessary assumptions are reasonable, explicitly stated, and supported.
[]	[]	[✓]	3.	Ensure calculations that use software include a paper printout, microfiche, CD ROM, or other electronic file of the input data and identification to the computer codes and versions used, or provide alternate documentation to uniquely and clearly identify the exact coding and execution process. Hand calculation 12-18-06
[✓]	[]	[]	4.	Input data were checked for consistency with original source information.
[✓]	[]	[]	5.	Key input data (e.g., dimensions, performance characteristics) that may affect equipment design is identified.
[✓]	[]	[]	6.	For both qualitative and quantitative data, uncertainties are recognized and discussed and the data is presented in a manner to minimize design interpretations.
[✓]	[]	[]	7.	Mathematical derivations were checked, including dimensional consistency of results.
[✓]	[]	[]	8.	Calculations are sufficiently detailed such that a technically qualified person can understand the analysis without requiring outside information.
[]	[]	[✓]	9.	Software verification and validation are addressed adequately.
[✓]	[]	[]	10.	Limits/criteria/guidelines applied to the analysis results are appropriate and referenced. Limits/criteria/guidelines were checked against references.
[✓]	[]	[]	11.	Conclusions are consistent with analytical results and applicable limits.
[✓]	[]	[]	12.	Results and conclusions address all points in the purpose.
[✓]	[]	[]	13.	Referenced documents are retrievable or otherwise available.
[✓]	[]	[]	14.	The version or revision of each reference is cited.
[✓]	[]	[]	15.	The document was prepared in accordance with Attachment A, "Calculation Format and Preparation Instructions."
[]	[]	[✓]	16.	Impacts on requirements have been assessed and change documentation initiated to incorporate revisions to affected documents, as appropriate.
[✓]	[]	[]	17.	All checker comments have been dispositioned and the design media matches the calculations.

S. M. O'Toole 12-18-06
Checker (printed name and signature) Date

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

Title: 241-BY-ITS1 Liquid Volume Calculation

Originator: K. J. Hull **Date:** 12/18/06

Checker: S. M. O'Toole **Date:** 12-18-06

Organizational Manager: D. G. Baide **Date:** 12/18/06

1.0 OBJECTIVE/PURPOSE

The objective of this calculation is to estimate the remaining liquid volume in 241-BY-ITS1 IX column and scrub solution circulation tank in accordance with M-23-26.

2.0 RESULT

The liquid volume in 241-BY-ITS1 IX column is 0 gallons. The liquid volume in 241-BY-ITS1 scrub solution circulation tank is 347 gallons.

3.0 BACKGROUND

The Hanford Federal Facility Agreement and Consent Order Milestone M-23-26 states:

"Submit to Ecology as a primary document a schedule for performing liquid level assessments for 241-AX-151-CT, 241-BY-ITS2 Tank 2, 241-AX-IX, 241-BY-ITS1. Assessments will include liquid level measurements using a manual tape or more accurate method, volume estimates, and a video inspection of the tanks and surrounding vaults sufficient to determine the waste is being stored in a manner protective of human health and the environment.

The schedule shall establish dates for all assessments of no later than December 31, 2006."

4.0 INPUT DATA

IX Column:

Exterior height of IX column is 9 ft per H-2-33481
The inside diameter is 17.5 in (based on 18 inch schedule 10 pipe).
Length of top hat is 36.25 in.
Measured distance from top of top hat to resin surface 80.5 in.
Distance from the top of the IX column to the flange on top of 3 in ball valve 17 in.
Resin screen 6 in above bottom of IX column per H-2-33481.

Title: 241-BY-ITS1 Liquid Volume Calculation

Originator: K. J. Hull **Date:** 12/18/06

Checker: S. M. O'Toole **Date:** 12-18-06

Organizational Manager: D. G. Baide **Date:** 12/18/06

Scrub Solution Tank:

Exterior height of scrub solution circulation tank is 50" (including 2" adapter flange) per H-2-50260.
Thickness of pump and agitator adapter flange is 2" per H-2-42622.
Conductivity probe liquid level reading is 2' 9" per field measurement.
Sludge weight reading (resting on bottom of tank) 5' 5" per field measurement.
Center rectangular section of tank interior is 39" wide by 45" long.
Round ends of the tank interior have a radius of 19.5".
The cooling coils inside the tank are 390' of 2" schedule 40 pipe per H-2-50261.
Nominal OD of 2" Schedule 40 pipe is 2.375"
The cooling coils start at 2.25" above the bottom of the tank and extend up to within 1.5" of the interior top of the tank.

5.0 ASSUMPTIONS

The volume displaced by the interior supports for the cooling coils in the scrub solution circulation tank is negligible. The calculation is conservative by excluding the displaced volume.

The rounded tank corners on the scrub solution tank are negligible and are excluded from this calculation.

Liquid volumes are rounded to the nearest gal.

6.0 METHOD OF ANALYSIS

This is a hand calculation.

Title: 241-BY-ITS1 Liquid Volume Calculation

Originator: K. J. Hull **Date:** 12/18/06

Checker: S. M. O'Toole **Date:** 12-18-06

Organizational Manager: D. G. Baide **Date:** 12/18/06

7.0 RESULTS

IX Column Liquid Volume Estimate:

Liquid volume based on hydraulic head = 0 gal.

IX Column Resin Volume Estimate:

Resin volume in the 241-BY-ITS1 IX column = (Top of top hat to bottom of column – distance to surface) × Area

Resin Volume = Depth × π × r^2
= Depth × π × $(8.75\ \text{in})^2$

Depth (resin) = Top of top hat to bottom of column – distance to surface of sludge

Depth = (36.25 in + 17 in + 108 in – 6 in) – 80.5 in
= 74.75 in

Resin volume = 74.75 in × π × $(8.75\ \text{in})^2$
= 17970 in^3 = 78 gal

Title: 241-BY-ITS1 Liquid Volume Calculation

Originator: K. J. Hull **Date:** 12/18/06

Checker: S. M. O'Toole **Date:** 12/18/06

Organizational Manager: D. G. Baide **Date:** 12/18/06

Scrub Solution Tank Liquid Volume Estimate:

Cooling coil volume $= \text{length} \times \pi \times r_{cc}^2$
$= 390 \text{ ft} \times 12 \text{ in/ft} \times \pi \times (2.375 \text{ in} \div 2)^2$
$= 20723 \text{ in}^3$

Cooling coil volume per inch of depth between 2-1/4" and 45-5/8" $= 20723 \text{ in}^3 \div (43\text{-}3/8")$
$= 478 \text{ in}^3/\text{in}$

Depth (sludge) = 0 in (per field observation)

Depth (liquid) = Sludge weight measurement – Conductivity probe measurement
= 65 in – 33 in
= 32 in

Volume (below 2.25 in) $= ((\text{length} \times \text{width}) + \pi \times r^2) \times 2.25 \text{ in}$
$= (45 \text{ in} \times 39 \text{ in} + \pi \times (19.5 \text{ in})^2) \times 2.25 \text{ in}$
$= 6635 \text{ in}^3 = 28.7 \text{ gal}$

Volume (2.25 in to 45.625 in) $= (\text{length} \times \text{width} + \pi \times r^2 - \text{cooling coil/in}) \times (\text{Depth} - 2.25 \text{ in})$
$= (45 \text{ in} \times 39 \text{ in} + \pi \times (19.5\text{in})^2 - 478 \text{ in}^3/\text{in}) \times (32 \text{ in} - 2.25 \text{ in})$
$= (2949 \text{ in}^2 - 478 \text{ in}^2) \times 29.75 \text{ in}$
$= 73{,}512 \text{ in}^3 = 318 \text{ gal}$

Total liquid volume = Volume (below 2.25in) + Volume (2.25 in to 45.625 in)
= 28.7 gal + 318 gal
= 347 gal

CONCLUSION

The liquid volume in 241-BY-ITS1 IX Column is estimated to be 0 gals. The resin volume in the 241-BY-ITS1 IX Column is estimated to be 78 gallons.

The liquid volume in 241-BY-ITS1 scrub solution circulation tank is estimated to be 347 gals.

Title: 241-BY-ITS1 Liquid Volume Calculation

Originator: K. J. Hull **Date:** 12/18/06

Checker: S. M. O'Toole **Date:** 12-18-06

Organizational Manager: D. G. Baide **Date:** 12/18/06

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