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OPTIONS FOR RESPONDING TO THE ASSUMED LEAK FROM CATCH TANK 241-UX-302A

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Abstract:
This document discusses options for responding to an assumed leak from catch tank 241-UX-302A and recommends a preferred path forward.

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OPTIONS FOR RESPONDING TO THE ASSUMED LEAK FROM CATCH TANK 241-UX-302A

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TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

LIST OF TERMS

AC	Administrative Control
cfm	cubic feet per minute
DOE	Department of Energy
DOT	Department of Transportation
DST	double-shell tank
ETF	Effluent Treatment Facility
HRA	high radiation area
SER	Safety Evaluation Report
SSC	structures, systems, and components
TSR	Technical Safety Requirement
VFD	variable frequency drive
WDOE	Washington State Department of Ecology
LERF	liquid effluent retention facility

EXECUTIVE SUMMARY

The purpose of this report is to document an assessment of various options evaluated for addressing catch tank 241-UX-302A, which has been declared an assumed leaking tank.

A continued monitoring and surveillance option was included due to the small volume of free liquid that remains in the tank (estimated at between 487 and 877 gallons) as identified from video surveillance of the tank interior. The tank has been previously isolated. The option provides monitoring of tank level using the installed ENRAF™.

A pumping option was included to remove residual liquid from catch tank 241-UX-302A, with the aim of reducing the volume of liquids that remains in the tank. The pumping option utilizes a pump and hosing to transfer liquid into a tanker. The tanker would then be used to transport the liquid to a Double-Shell Tank (DST) or to the Liquid Effluent Retention Facility (LERF) for off loading. A camera would be placed into the tank to aid in the pump installation and with the liquid level assessment.

Other options considered included constructing an interim surface barrier over 241-UX-302A, increasing the evaporation rate in an attempt to remove remaining liquid, and the addition of absorbent material to retain the liquid inside 241-UX-302A.

The recommended options from this evaluation is to remove the remaining pumpable liquid from the tank (Section 4.2) and to continue to perform monitoring and surveillance on the catch tank contents (Section 4.1). After pumping, minimal free liquid with less than an estimated 1.2 curies of radiological material will remain in catch tank 241-UX-302A. The remainder of the radiological inventory is believed to be in the solids. Liquid level monitoring will detect if any additional liquids infiltrate the catch tank after the pumpable liquids have been removed. This option has advantages in that it minimizes the available liquid that could possibly leak and cause further migration of contaminants into the soil and preserves detection capability should future liquid intrusion occur.

An option to only apply continued monitoring and surveillance, while cost effective and easily implemented, does not offer the ability to minimize the available liquid that could possibly leak and cause further migration of contaminants into the soil.

The other options presented in this evaluation were not selected due to viability concerns, limited effectiveness, uncertainties or potential adverse impacts for the final clean-out and closure of the tank.

Where information regarding treatment, management, and disposal of the radioactive source, byproduct material, special nuclear material (as defined by the Atomic Energy Act of 1954, as amended) and/or the radionuclide component of mixed waste has been incorporated into this report, it is not incorporated for the purpose of regulating the radiation hazards of such components under the authority of this report and chapter 70.105 RCW.

1.0 BACKGROUND

Tank 241-UX-302A (UX-302A) is a direct-buried underground catch tank installed in 1947 to collect drainage from UX-154 diversion box. It is located in the 200 West Area, Southeast of U Plant (between U Plant and its tall stack). The tank is a horizontally oriented welded cylindrical vessel constructed of 9/16 inch thick carbon steel plate; approximately 39 feet long with 9 feet outside diameter and dished ends (see Appendix A for tank detail). The center line of the tank is located 24 feet underground. The interior received six coats of Amercoat #55™, a commercial coating used for protection from corrosion.

An 18 inch flanged connection in the center at the top of the tank reduces to a 12 inch riser that is connected to the underside of a pump pit. There are two ground level 4 inch risers on the tank; one has a center line located 3'-0" South West of the 12" riser (location of ENRAF™) and the second has a center line located 5'-6" South West of the above mentioned 4" riser (spare). There are also two underground drain lines from the 241-UX-154 diversion box that enter at the top of the tank and an underground capped line to the steam jet siphon box connection at the tank.

UX-302A likely received some U Plant Uranium Recovery Waste spillage from the diversion box during the 1950s. The Uranium Recovery process shutdown in 1958. Its recent content has consisted of transfer line flushes or hydro tests, rainwater and snowmelt plus traces of drainage from the diversion box, the encasement for the old cross-site transfer system and U Plant stack. The liquid was sampled in June 2002 and the composition is what would be expected from slightly contaminated rainwater. The pH was approximately 8.

An integrity assessment, completed in 2001 (*Engineering Report on Double-Shell Tank System Miscellaneous Tanks*, RPP-6829), concluded that UX-302A was not leaking. UX-302A received intrusions of 300-400 gallons per year, until early in 2003 and was last pumped out in January 2003. Weather sealing of the associated diversion box was performed in September 2003 and isolation of the U-Plant exhaust stack drain was completed in April 2005, successfully sealing the intrusion boxes. UX-302A was taken out of service in June 2005 as part of the M-48-07 Tri-Party Agreement (TPA) milestone.

As of March 1, 2006, it was estimated to contain 1724 gallons, based on an ENRAF™ level of 16.61 inches. An in-tank video was subsequently performed March 31, 2006 and based on that video, the surface level is judged to be at 10.4 inches. This would correlate to a waste volume of 877 gallons. On May 4, 2006, an elevation survey of the ENRAF™ riser flange found that the flange was about 6 inches lower than the drawing elevation. The difference is consistent with the video evaluation of the surface level. The estimated volume and tank conditions are discussed in more detail in the leak assessment report (RPP-RPT-29711).

On March 2, 2006 Problem Evaluation Request (PER) 2006-0501 was written to respond to the observed surface level change in UX-302A between June 2004 and February 2006. The recommended corrective action associated with the PER-2006-0501 was to determine why the decrease in liquid level was occurring. The level, as measured by the ENRAF™ gauge, had decreased from 17.29 inches (1823 gallons) to 16.61 inches (1724 gallons). The magnitude of the decrease (0.68 inches) had not exceeded the OSD-T-151-00031 threshold (1-inch decrease) for entering the leak assessment process. But, because there was no clear explanation for the behavior, on March 22, 2006, CH2M-HILL Hanford Group, Inc. (CH2M HILL) management decided that the level trend warranted entering the leak assessment process (*Tank Leak Assessment Process,* TFC-ENG-CHEM-D-42).

The evaluation process was implemented using an assessment panel of experienced CH2M HILL Hanford Group, Inc engineers and managers to review the data and investigate the possible causes.

Based on extensive discussion of the available data, the participating experts agreed that these were plausible hypotheses based on the data in hand.

1. Leaker Hypothesis: Tank 241-UX-302A has a pin-hole leak at approximately the 10.5 inch level. ENRAF™ liquid level measurements indicate that UX-302A has lost approximately 100 gallons between March 1, 2004 and January 1, 2006, but is not currently leaking.
2. Non-Leaker Hypothesis: The ENRAF™ liquid level measurement decreased due to an ENRAF™ bias or evaporation. If the level loss is due to evaporation, the air flow through the tank has been reduced and evaporation is now suppressed.

The consensus of the assessment team, as stated in *Tank 241-UX-302A Leak Assessment Report* (RPP-RPT-29711), is that all available data indicate that the leak hypothesis is the most likely explanation for the ENRAF™ level trend. The assessment team recognized that the small volume changes could also be explained by evaporation, but because there was no plausible explanation for a change in air flow that would cause evaporation to stop, evaporation was determined to be a less likely explanation. The recommendation of the assessment team is that UX-302A be declared an assumed leaking tank.

From May 17 until August 10 ENRAF™ liquid level measurements have indicated the same level $\pm$ 0.01 inches. See Appendix B, Figure B-2.

2.0 WASTE CHARACTERIZATION

Tank 241-UX-302A is the catch tank for drainage from the UX-154 diversion box. The catch tank was tied into the 291 U stack (isolated in 2005) and encasement drains. Over the years, liquid in the tank was pumped out to maintain the level within operational limits. The tank was last pumped in January 2003.

UX-302A likely received some U Plant Uranium Recovery waste spillage from the diversion box during the 1950s. Recent receipts have consisted of flushes, rainwater, and snowmelt as part of the small amount of drainage from the diversion box, the encasement for the old cross-site transfer system, and U Plant stack. The liquid was sampled in June 2002 and the composition is what would be expected from slightly contaminated rainwater. The pH was approximately 8. The sample results for the liquid are shown in Table 2-1.

Since the sampling event, liquid in the tank was pumped out just once in January 2003, as indicated above. The sample results should be indicative of the liquid in the tank.

The analysis in *Tank 241-UX-302A Leak Assessment Report* (RPP-RPT-29711) concluded that the total volume of waste in the tank was about 877 gallons. The volume of solids in UX-302A is unknown but is probably 390 gallons or less. 390 gallons corresponds to a waste level of 6 inches, the level the tank was pump down to in 2003. By difference, the liquid volume ranges from a minimum of 487 gallons (6 inches of solids) to a maximum of 877 gallons (no solids).

There is no sample data for the solids. To estimate the inventory of radionuclides, the solids are assumed to be the same as the tank waste generated at U plant. The estimated concentrations of U plant (Uranium Recovery) solids are shown in Table 2-2. Using these concentrations, the tank could contain as much as 256 curies of strontium-90 and 28 curies of cesium-137.

The catch tank is likely to contain some U Plant solids that were flushed from the diversion box. However, the solids in the catch tank are expected to be a mixture from the flushes and wind-blown dust and sand that were carried into the tank from water runoff. The use of the estimate of U plant solids is extremely conservative and the concentrations in Table 2-2 should be considered upper bounds for the UX-302A solids.

Table 2-1. Tank UX-302A Liquid Composition

Constituent	Concentration	Concentration Unit
Na	150	µg/mL
NO_3	20.1	µg/mL
NO_2	<0.658	µg/mL
F	0.0933	µg/mL
Cl	12.2	µg/mL
SO_4	27.6	µg/mL
Al	<2.5	µg/mL
Fe	<2.5	µg/mL
Total inorganic carbon	74.5	µg/mL
Total organic carbon	<40	µg/mL
Total U	18.7	µg/mL
^{90}Sr	0.455	µCi/mL
^{137}Cs	0.0475	µCi/mL
$^{239/240}Pu$	5.95E-06	µCi/mL
SpG	1.004	Unitless
pH	8.1	Unitless
Reference FH-0203447, *Tank 241-UX-302A FY2002 Grab Samples Analytical Results for the Final Report*		

Table 2-2. Concentration of Uranium Recovery Solids

Constituents	Concentration	Unit
^{90}Sr	118	µCi/g
^{137}Cs	127	µCi/g
$^{239/240}Pu$	0.0124	µCi/g
Total U	11,700	µg/g
Total organic carbon	680	µg/g
Total inorganic carbon	1,490	µg/g
Density	1.47	g/mL
Weight percent water	50.5	%
Al	1,800	µg/g
Fe	19,900	µg/g
Cl	1,400	µg/g
Si	545	µg/g
Ca	2,620	µg/g
Reference RPP-RPT-29711, *Tank 241-UX-302A Leak Assessment Report*		

3.0 ENVIRONMENTAL IMPACT OF ASSUMED WASTE RELEASE

Based on the tank history and waste characterization data discussed in the previous section, the material that may have been released to the environment due to the assumed leak from catch tank UX-302A is anticipated to be water with low levels of radiological and toxicological contamination, primarily resulting from rainwater/snowmelt collection in the tank. The maximum volume of waste remaining in the tank is estimated to be 877 gallons (~3300 liters). Accounting for the estimated volume of solids in the tank, the liquid in the tank is between 487 and 877 gallons. 600 gallons represents a conservative estimate of the combined volume that may have already leaked plus the remaining free liquid that may still be available to leak. Based on 600 gallons of material and using the radionuclide concentrations for the liquid from the 2002 sample results, the total radiological inventory of the liquid that has leaked or is available to leak is estimated at less than 1.2 Ci. The actual radionuclide content of the liquid is anticipated to be less than this value due to dilution with intrusion water since the date of sampling.

The migration of this released material is anticipated to be minimal, based on the limited volume of liquid available to leak. UX-302A sits on a bed of sand that was used to provide an even base on which to place the tank. If sufficient surface recharge were available, movement of the leaked material would be downward until a spreading horizon was encountered, and at that point the "plume" would spread predominantly in the horizontal direction.

The native soils in the vicinity of UX-302A are predominantly sandy gravel in nature, and are part of the Hanford formation. The thickness of the vadose zone in this area, below the base of the tank excavation, was greater than 200 feet in the 1980s. Liquid discharges were discontinued in the 200 West Area in the 1980s and 1990s, which has caused the water table to drop rapidly. There is no known down-gradient groundwater well, used for potable supply, within five miles. The closest accessible surface water body is the Columbia River.

Due to the limited volume available to leak and the associated characteristics of the vadose zone near UX-302A, it is unlikely that contamination will reach groundwater. Also, it is unlikely that the sand bed directly under UX-302A was fully saturated by liquid before the leak. As such, the sand bed would have delayed the downward spread of contamination until it became saturated with liquid.

4.0 MITIGATION OPTIONS FOR 241-UX-302A CATCH TANK

The following options are alternative approaches for addressing the potential consequences resulting form the liquid in catch tank 241-UX-302A and associated contamination concerns. The options are methods to remove or inhibit the migration of liquid associated with this catch tank. In addition to these options, tank monitoring and intrusion prevention will be considered but specific details are not within the scope of this document.

4.1 CONTINUED MONITORING AND SURVEILLANCE OPTION

This option proposes that continued monitoring and surveillance of the liquid level in catch tank UX-302A be performed to detect and provide indication of future liquid intrusion in this tank should it occur. This could be accomplished with an ENRAF™ similar to what is presently used.

Viability:

This option is viable. However, it only confirms status or serves as a warning system. It does not mitigate liquids by itself. It is most effective when used in conjunction with another mitigation option. This option is cost effective and easily implemented.

Estimated Effectiveness of Option:

1) Does not eliminate the potential for leakage. However, the environmental impact of the assumed leak is low.
2) Leaves between 487 and 877 gallons of free liquid waste in the tank.
3) In the event a new leak site occurred this volume would gradually reduce until the level of the leak site is reached.

Benefits to this approach:

1) No waste intrusive work would be performed.
2) No liquid waste would be transferred out of the tank or require transport to a new tank.
3) Minimizes the potential for radiological exposure/contamination to employees.
4) There is an existing ENRAF™ for monitoring liquid levels in the catch tank.
5) Residual free liquid volume available to leak is small and consists predominantly of low level contaminated rainwater and snowmelt.
6) The environmental impact of a continued leak is low, as previously discussed in Section 3.0.

Risks with this approach:

1) Should leak paths occur in the tank, then the liquid in catch tank 241-UX-302A would continue to leak to the environment until the liquid level reaches the leak point or the catch tank is empty.
2) Should liquid intrusion by rainwater or snow melt occur at a rate less than or equal to the assumed catch tank leak rate then leakage to the vadose zone could occur undetected.

Radiological hazards associated with this approach:

1) No radiological hazards to the occupational worker are encountered with this option.

4.2 PUMP CATCH TANK UX-302A INTO TANKER

Several pump options are being considered for mitigation of liquids in UX-302A. The pump may be operated utilizing an electric, pneumatic or hydraulic system. In reviewing pump options for catch tank 241-UX-302A, the major consideration is finding a pump that is able to be inserted through a 4" diameter riser. Two 4" diameter risers are available into the UX-302A catch tank, one located 3 feet and the other 8 feet from the tank center. The riser 8 feet from center is a spare and the other is currently used for the ENRAF™. There is a central 12" diameter riser that is occupied by the currently installed transfer pump. This 12" riser could be used but would require significant work to remove and dispose of the existing transfer pump. A further important consideration is that the pump should be readily available and does not require unique design prior to implementation. Based upon the dilute nature of the waste, it was determined that pumps commonly utilized for groundwater sampling would be effective at removing the liquid waste.

This option utilizes a tanker for waste collection and transfer. The tankers are available from the Effluent Treatment Facility (ETF). The tankers are available with top fill, top discharge or top fill, bottom discharge configurations. Details of the pumping operation are:

1) Tank risers will be prepared for installation of pumping equipment and a passive breather filter.
2) A pump and hosing will be installed in the spare riser of catch tank UX-302A. The pump and hosing will be sleeved as they are removed from the tank for contamination control.
3) The liquid will be pumped from catch tank UX-302A through a hose connected directly to the pump discharge. This hose extends out of the riser and is connected to an optional filter located at grade.
4) An optional in-line filter may be used to remove particulates from the liquid discharged from the pump before it enters the tanker. Whether a filter is used, and the fineness of the filter, would depend on the tanker used to receive/transport the liquid, the waste acceptance criteria of the disposal destination, and other engineering considerations.
5) A fitting will be attached to the top of the tanker to allow connection of the hose for pumping or a water line for flushing the tanker.
6) All hosing and connections will be sleeved to allow daily visual inspection for leaks, as required by WAC 173-303 for single-walled waste transfer hose at grade.
7) A HEPA filter will be used on the tanker to vent during pumping. Venting is required to prevent pressurization of the tanker.
8) A water truck will be available to perform flushing of the pump screen and the tanker, as necessary.
9) Liquid removal may require the addition of some water into catch tank UX-302A to lance a hole into the solids for receipt of the pump. This open space will allow placement of

the pump as close to the bottom of the tank as possible to maximize retrieval of liquids. Also, the open space will minimize the uptake of solids.

10) A camera system will be installed in the riser currently containing the ENRAF™ to aid in pump installation and liquid level assessment.
11) Once UX-302A is pumped, the tanker will transport the liquid to either the perimeter of a DST Tank Farm or LERF depending on compatibility.
12) Hoses are then connected to a Riser on the DST or to LERF and the tanker pressurized to transfer liquid.
13) Multiple flushes of the tanker may be performed to reduce dose rates to required levels for return to ETF.
14) The tank will be returned to the original configuration.

Viability:

This option is viable. However, while it initially mitigates the liquid, it does not have the ability to address potential future liquid intrusions. It would be most effective when used in conjunction with the continued monitoring and surveillance option (Section 4.1)

UX-302A has a near optimum configuration for pumping the free liquids. It has readily available risers, few in-tank obstructions, and (based on video evidence) a high percentage of the waste consists of clear, free liquids and not solids.

This option is recommended for remediation of the liquid in the UX-302A catch tank. This option can be implemented in a near-term timeframe and removes most of the liquid capable of leaking out of the tank.

Estimated Effectiveness of Option:

1) A small diameter pump installed in a south-west tank riser should be capable of pumping down to below 1-inch of liquids.
2) The remaining free liquid volume is estimated to be less than 100 gallons (less than 1% of tank capacity).
3) Based on pump flow rates the available free liquid could be removed in 2 to 6 days or less.

Benefits to this approach:

1) This option can be readily implemented and uses familiar equipment and technologies for tank farms.
2) This option would immediately reduce the volume available to leak to the environment. This would further reduce the risk to the environment.
3) Tankers are available for use here at the Hanford Site.

Risks with this approach:

1) Elevated dose rates on the tanker in the event solids are retrieved.
2) A risk of spread of radiological contamination when installing and removing equipment from tank risers and from making and breaking connections.
3) A one-time DOE waiver for transport liquids may be required if dose rates exceed 200 mR/hr on contact with the tanker.
4) A safety basis amendment or one-time approval from the Department of Energy, Office of River Protection is required to allow waste transfers utilizing a tanker truck, and without requiring current Technical Safety Requirement controls for waste transfers (e.g., pit leak detectors, material balances)

Radiological hazards associated with this approach:

1) If in-line filtration is not used, solids carry-over could significantly increase the radiological dose rates on the tanker.
2) The spread of radiological contamination may result when performing the following activities:
   - Removing/installing equipment in tank risers;
   - Leaks from hoses/fittings during transfer; and
   - Leaks from hoses, fittings while dissembling transfer system;

Table 4-1. Cost Estimate for Pumping into Tanker

Equipment Cost	
- Pumps and hoses	$22,000
- Camera system	$30,000
Labor Cost	
- Field labor cost total	$138,000
- Engineering support	$160,000
Disposal Cost	
- 6'x3'x3' mixed waste container	$15,600
- 8'x4'x4' low level waste container	$7,300
Total Cost	**$372,900**

Table 4-2. Labor Estimate for Pumping into Tanker

Activity Description	Shift Total	Description
Equipment set-up at 241-UX-302A	5	Remove ENRAF™, install pump, test tanker, stage tanker, connect equipment, sleeve equipment and establish HRA around tanker and optional filter housing.
Pump liquid from 241-UX-302A into Tanker	6	Time allotted for pumping and flushing activities
Transport liquid to DST	½	Roads may have to be closed if dose rates exceed 200 mR/hr.
Equipment set-up at DST	2	Connect hoses to DST, sleeve hoses, and connect air compressor to truck.
Post Tanker DST Staging Area as HRA	½	Fence paneling may be necessary to control access to HRA.
Pump liquid from Tanker into DST	1	< 500 gallons total expected to be transferred
Decontaminate Tanker	½	Minimal solids anticipated to be present. However, several tanker flushes may be necessary.
Dispose of contaminated equipment	2	This includes pump at 241-UX0302A and hoses at both UX-302A and DST. Additional time allotted since camera and pump removal may be time consuming due to contamination/dose concerns.
Reinstall ENRAF™ at 241-UX-302A	½	
Total Shifts	**18**	
Note: Field resource shift estimates include the following resources: five operators, four HPTs, one field work supervisor, one industrial hygiene technician, two fitters, one electrician, one teamster, two mechanical engineers, one radiological control manager and one facility manager.		

Figure 4-1. Configuration for Pumping Catch Tank 241-UX-302A into Tanker (Bottom Unloading Tanker)

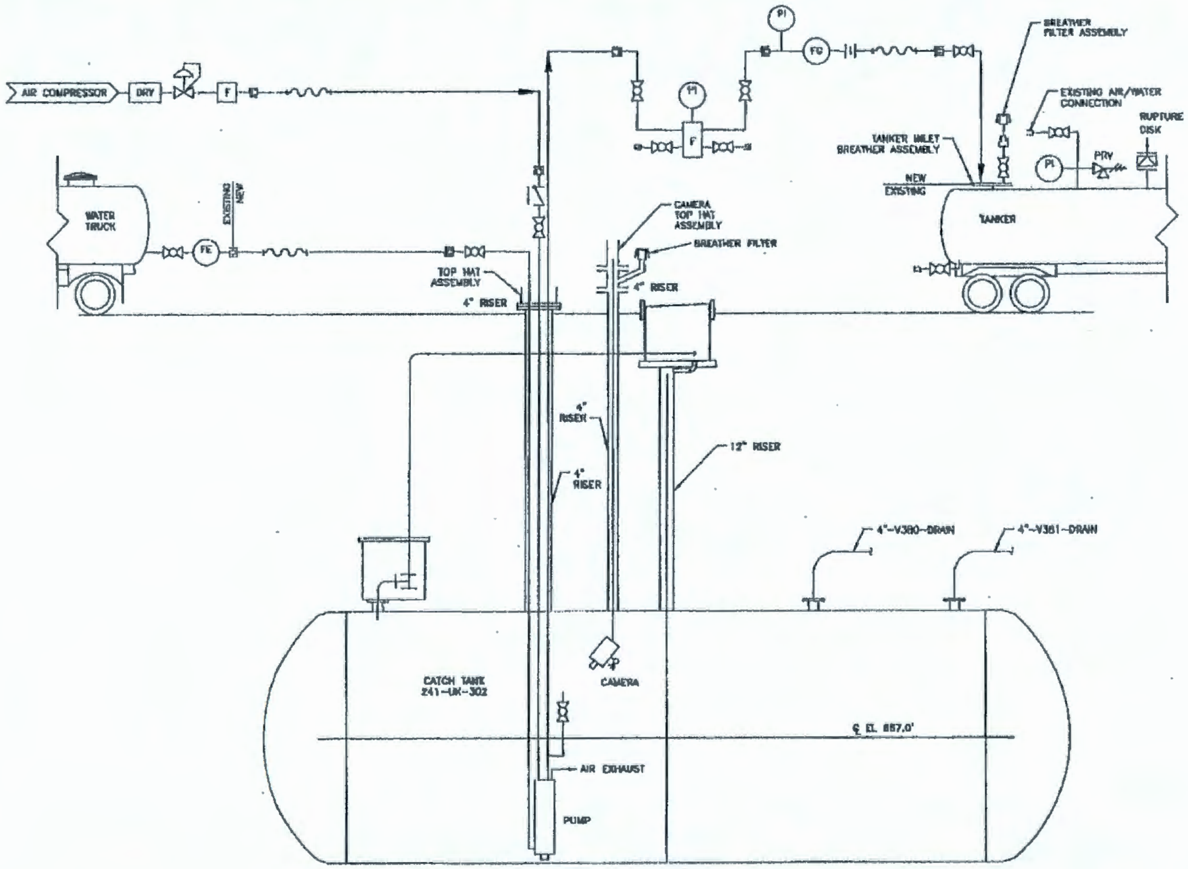
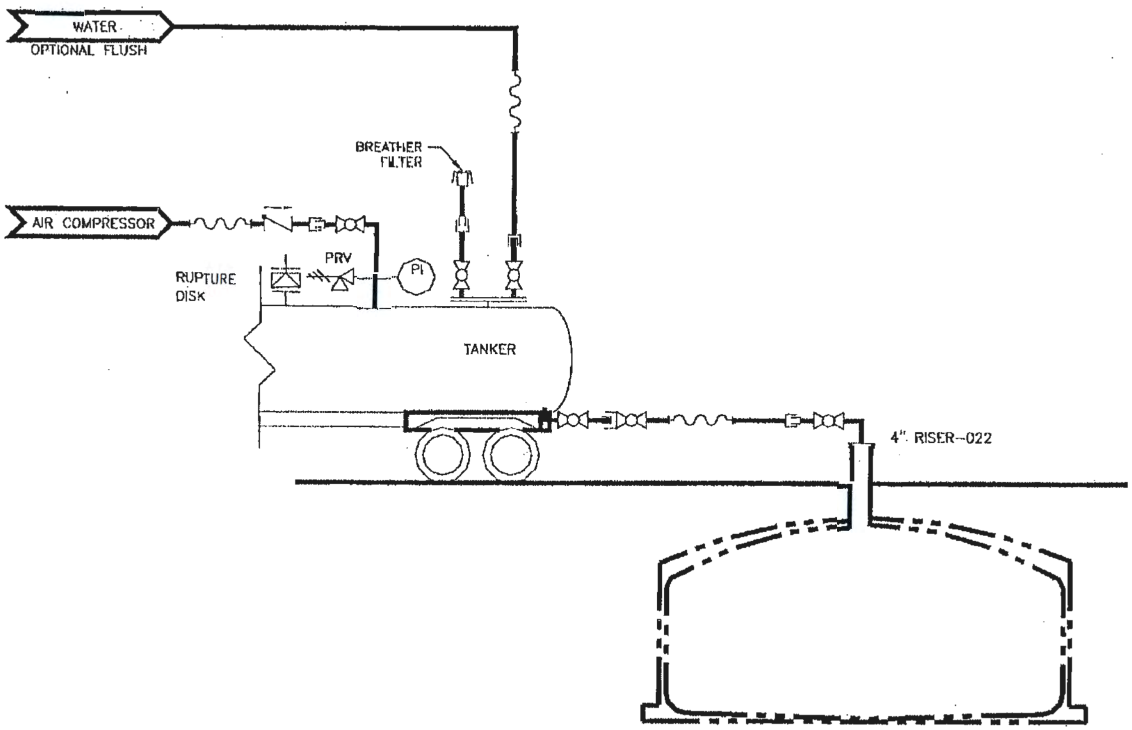


Figure 4-2. Configuration for Pumping Tanker to DST (Bottom Unloading Tanker)



4.3 INSTALLATION OF AN INTERIM SURFACE BARRIER

This option proposes that an interim surface barrier be installed around the perimeter of catch tank 241-UX-302A, to prevent migration of any contaminants introduced into the soil. A polyurea barrier (Envirolastic AR 425) may be applied on the surface area surrounding catch tank 241-UX-302A as an interim measure to restrict precipitation infiltration into the contaminated zone, thereby retarding the movement of contamination downward through the soil column. For the purposes of cost estimates below, it was assumed that polyurea cover would be applied to a 100 feet by 100 feet area. This area would extend beyond the perimeter of the area occupied by tank 241-UX-302A and would cover the assumed leak from the tank.

In addition to the barrier, the following additional activities have or will be completed to isolate infiltration pathways into catch tank 241-UX-302A to prevent the accumulation of additional liquids:

1) Closing the valve on the drain line between the 291-U stack and catch tank 241-UX-302A (ECN 723081).
2) Isolating power to the 241-UX-302A diversion box (241-UX-154) and applying a weather enclosure over the pump pit (ECN 723340).

Further details of this option are provided below:

1) Mark out area to be covered. A conservative area of 100 feet by 100 feet directly over the area occupied by 241-UX-302A catch tank is assumed adequate.
2) Ensure area requiring polyurea barrier has sufficient slope to prevent pooling of liquid. This may be achieved either by grading the existing surface material or preferably by bringing in and grading clean sand over the area to be covered.
3) Apply fabric to area requiring interim barrier.
4) Spray polyurea on fabric to make a two layer barrier. The perimeter of the barrier should have a channel to divert liquid run-off to desired location.

Viability:

This option has limited viability and it only addresses minimizing previously leaked contaminant migration. It does not address mitigation of the liquid in the catch tank. The limited volume available to leak and the associated characteristics of the vadose zone near UX-302A, as discussed in section 3.0, reduces the effectiveness of this option. This option could be used in conjunction with other mitigation options.

Estimated Effectiveness of Option:

1) The contaminant plume is assumed to be small. Up to 600 gallons of liquid may have already leaked to the soil and between 487 and 877 gallons of free liquid remains in the tank. Application of a surface barrier would minimize further migration of contamination, thereby reducing further the environmental impact of the assumed release.

Benefits to this approach:

1) Minimizes contaminant migration. Elimination of infiltration minimizes downward transportation of contamination. This approach would leave liquid in the catch tank that could eventually leak to the soil. However, the small volume of the liquid waste in the tank would likely have a small impact on the environment.
2) Minimize worker exposure – This option does not require removal of contaminated soil, nor does it involve any tank intrusive work.
3) Qualifies as an Interim Measure (TPA Milestone M-45-56) as part of the RCRA Corrective Action Program with a streamlined regulatory approval process.
4) This technology will be used to cover the 241-T-106 contamination area in FY07, plus three other areas at later dates, as part of TPA Milestone M-45-56.
5) Provides demonstration of technique and additional design information for later interim surface barriers.

Risks with this approach:

1) The area requiring application of an interim surface barrier must be hand graded to promote run-off prior to installing the felt. Grading could adversely affect the previously stabilized surface and the associated sub-surface contamination. This could be offset by the addition of clean sand.
2) The life span of the barrier is unknown, but is expected to be 30 years. Repair or patching of damaged or degraded sections is possible but would increase long term costs.
3) Supplied air must be used when applying polyurea because fumes are toxic.
4) Cost – The current cost may not adequately bound the proposed activity, since this will be the first application of the material. The polyurea application may be contracted out.
5) Between 487 and 877 gallons of liquid waste, containing an estimated 1.2 curies of radiological material, will remain in the tank and could leak to the environment if a new leak point develops or new liquid infiltrates catch tank 241-UX-302A.
6) The land that catch tank 241-UX-302A is managed by Fluor Hanford and therefore creates additional interface and authorization requirements with performing facility modifications.

Radiological hazards associated with this approach:

1) Radiological risks for this activity would be limited to the potential for radiological contamination during activities that may disturb the potentially contaminated soil surface. Radiological exposure is not anticipated to present a significant risk to workers while applying the polyurea barrier. Application of the interim surface barrier requires sloping of the area and may result in disturbing the stabilized surface. A layer of sand/gravel may also be applied to obtain the desired slope and minimize disturbance of existing stabilized surface.

Table 4-3. Cost Estimate for Application of Interim Surface Barrier
Note: Cost Estimates are from 241-ER-311 Options Report (RPP-RPT-29484)

Material Cost	
- Sand/Gravel	< $500
Labor Cost	
- Polyurea application cost (including cost for contractor application)	$40,000 to $45,000 ($4.00 to $4.50 per square foot)
- Training for contractor	$5,000
- Field Work Supervisor (FWS)	$6,340 to $9,800
- Nuclear Chemical Operators (NCOs)	$2,835 to $4,725
- HPT (survey equipment, soil, etc.)	$6,430 to $10,105
- IHT	$3,645 to $5,470
- Engineering (primarily design support)	$6,150 to $9,225
Planning	
- Work order preparation (includes time for planner, as well subject matter expert review).	$10,000
Total Cost	**$80,920 to $99,825**

Table 4-4. Labor Estimate for Application of Interim Surface Barrier
Note: Cost Estimates are from 241-ER-311 Options Report (RPP-RPT-29484)

Activity Description	Shift Total	Description
Ensure polyurea application area is sloped to facilitate run-off	3 to 5	The activity will require area to be hand graded. While new gravel/sand may be placed to obtain desired slope, this estimate assumes existing gravel (potentially contaminated) will be redistributed as necessary. A run-off collection system may need to be formed at the perimeter of the barrier application area. Required Tank Farms field resources include: two NCOs, two HPTs and one FWS.
Apply fabric to polyurea application area	1 to 2	Required Tank Farms field resources include: one HPT, one FWS, and one IHT.
Spray on polyurea barrier	7 to 10	This activity must be performed on supplied air. Application area is anticipated to be 10,000 square feet. Required Tank Farms field resources include: one HPT, one FWS, and one IHT.
Total Shifts	**11 to 17**	

4.4 DRY-OUT TANK 241-UX302A WITH EXHAUSTER

This option utilizes a portable exhauster to increase evaporation rates in 241-UX-302A in an attempt to remove remaining liquid inventory. The portable exhauster would be connected to the spare riser at catch tank 241-UX-302A. Further details of the option are provided below:

1) Connect a portable exhauster to enhance evaporation of liquid.
2) This option would require a tank vacuum relief and control device to be added.
3) This activity would require removal of the ENRAF™ to reconfigure the tank for the portable exhauster system. The ENRAF™ would have to be reinstalled once the tank is reconfigured with the portable exhauster arrangement to meet environmental requirements for level monitoring.

Viability:

This option has less viability than the preferred option of pumping the free liquids out of the catch tank. While coupling an exhauster to the catch tank will enhance evaporation, the rate of evaporation depends on contact between the introduced air and the liquids currently in the catch tank. Evaporation will increase as the surface area of contact increases, and decrease as the surface area of contact decreases. Introducing air through one 4-inch riser and exhausting it out of another 4-inch riser only 5 ½ feet away will result in less effective contact between the air and the liquid. While this limitation can be partially mitigated by installing a drop leg on the air inlet, or injecting dried air into the catch tank, it nevertheless represents a significant shortcoming of the approach. Limited contact will restrict the effectiveness of the evaporation option, prolong the time required to remove liquids from the catch tank, and increase the likelihood that a tank leak could result in the migration of waste into the environment.

The lack of a readily available exhauster further restricts the near term viability of this option. The previously available 500 CFM portable exhauster that was intended to be utilized for S-109 retrieval activities will be deployed for mitigation of liquids in catch tank 241-ER-311. There are two new 3,000 CFM exhausters available, but they will required modification, maintenance and testing prior to use.

While this option mitigates the liquid it does not have the ability to address potential future intrusions. It would be more effective when used in conjunction with the continued monitoring and surveillance option (Section 4.1).

Estimated Effectiveness of Option:

1) This option would enhance the evaporation of liquid from 241-UX-302A. However, 241-UX-302A does not have an optimum configuration for evaporation. Liquid retrieval from catch tank 241-ER-311 will utilize the option of evaporation. The configuration of 241-ER-311 uses a system deployed through risers penetration located on opposite ends of the tank to maximize contact between air moving through the tank and the liquid waste. The configuration of 241-UX-302A requires the use of risers spaced only 5 ½ feet

apart and located off-center toward one end. As a result, an evaporative system deployed on 241-UX-302A would create only limited contact between air moving through the tank and the liquid waste. The less than optimum configuration reduces the likely effectiveness of the evaporative option.

Benefits to this approach:

1) Reduces contact radiological hazards associated with removing waste from tank and dose associated with transfer lines and waste transport. All modification work is above grade and would be limited to access at top of risers.
2) Minimizes disposal costs – a subsequent transfer via a secondary transport vehicle is not required.

Risks with this approach:

1) Extended period of time required to remove the catch tank's liquid contents.
2) The tank would have to be evaluated to ensure it did not collapse under anticipated vacuum.
3) Limited availability of exhauster systems.
4) Several regulatory permits would be required as listed below:
    a. Radiological air emissions with Washington Department of Health (WDOE)
    b. Non-Radiological air emissions with WDOE
5) Cost – Equipment would have to be tested, installed and maintained for duration of activities.
6) While the portable exhauster is operating, the sensitivity of the ENRAF™ may be reduced due to the increased air flow through the tank.

Radiological hazards associated with this approach:

1) The estimated dose rates are sufficiently low that the area would likely remain below the level requiring posting as a radiation area
2) The spread of radiological contamination may result when removing/installing equipment on tank risers (i.e., portable exhauster, zip cord, etc.).

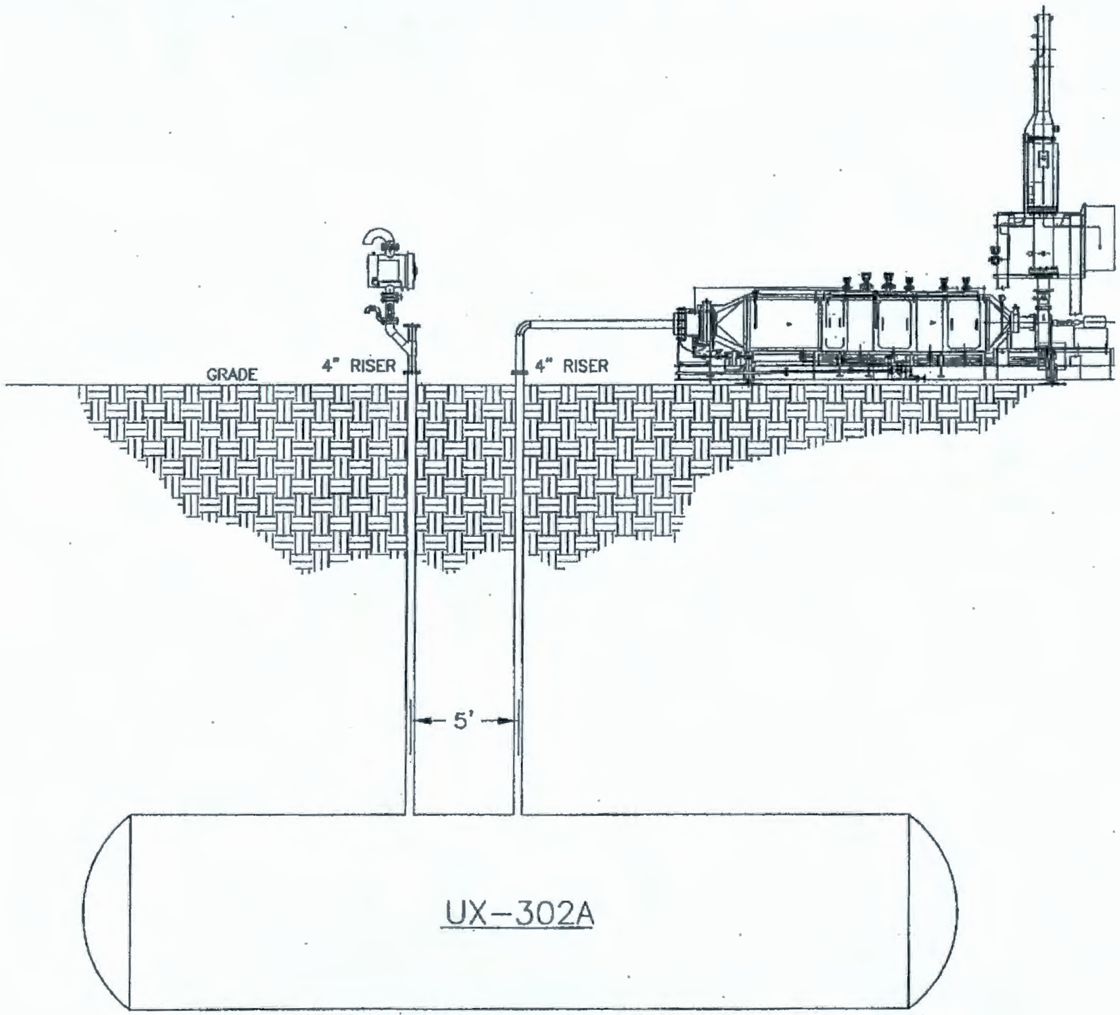
Table 4-5. Cost Estimate to Dry-Out Tank 241-UX-302A with Exhauster

Equipment Cost	
- Portable exhauster testing, set up, and maintenance	$47,300
Labor Cost	
- Field labor cost total	$142,300
- Engineering support	$131,200
- Testing and training	$73,200
Total Cost	**$394,000**

Table 4-6. Labor Estimate to Dry-Out Tank 241-UX-302A with Exhauster

Labor Estimate (by activity):	**Shift Total**	**Description**
Equipment set-up	15	Remove ENRAF™, install exhauster, replace breather filter with tank vacuum relief and control device, install level detection device on breather filter spool piece on East riser.
Reconfigure catch tank	10	Remove portable exhauster and tank vacuum relief and control device; reinstall ENRAF™ and breather filter
Perform video inspection of tank	2	May be required once majority of free liquid is removed.
Total Shifts	**27**	
Note: Field resource shift estimates include the following resources: five operators, four HPTs, one field work supervisor, one industrial hygiene technician, two fitters, one electrician, one teamster, two mechanical engineers, one radiological control manager, and one facility manager.		

Figure 4-3. Configuration to Dry-Out Tank 241-UX-302A with Exhauster



4.5 ADD ABSORBENT MATERIAL TO 241-UX-302A

This option stabilizes UX-302A residual liquid with absorbent material. Absorbent material would be added via the two 4-inch risers to absorb remaining free liquid. The risers are located three feet and eight and a half feet respectively to the southwest side of tank center. A distribution system would have to be developed to ensure adequate dispersion of the absorbent material. Absorbents such as Super Absorbent Polymers, diatomaceous earth, etc., may be utilized to absorb the free liquid to minimize additional leakage of waste to the soil.

Viability:

This option is not considered viable for near term use in the UX-302A catch tank since the specific installation details and consequences of the addition of absorbents is unknown. Potential complications of the final clean-out and closure of the tank, regulatory acceptance, effectiveness, absorbent service life, dispersion, and retrieval are uncertain. Future research, testing and evaluation are required prior to use of absorbents. However, this option has the potential of being a future stand alone mitigation option.

Estimated Effectiveness of Option:

1) Approximately 0.4 to 1.5 pounds of absorbent required per gallon of liquid.
2) If complete dispersion of the absorbent could be achieved, all residual liquid could be absorbed.
3) However, access is only readily available through two 4" risers just off center of the tank spaced 5 ½ feet apart. Complete dispersion will be difficult unless an engineered system is designed to blow or pump absorbents throughout the tank.
4) Actual efficiency is difficult to predict accurately without testing but will likely be equal to or less than pumping option, due to difficulty of dispersion.
5) Large volumes of absorbent could be required to compensate for dispersion inefficiency.

Benefits to this approach:

1) Reduces radiological hazards associated with removing waste from the tank and the dose associated with transfer lines and waste transport
2) This approach would stabilize the majority of remaining free liquid and significantly slow further waste migration to the environment. This further reduces the environmental impacts associated with the waste leak.

Risks with this approach:

1) The use of absorbents in catch tank UX-302A presents unique challenges. The absorbent delivery system must have characteristics and dimensions suitable for vertical deployment through a 4-inch riser. The system must have the ability to deliver the absorbent horizontally. The delivery system must have the ability to propel absorbent to or near the edges of the catch tank (approximately 18 feet). The absorbent must have the ability to

withstand the deleterious effects of exposure to low-level radiation for years until tank closure will occur. Currently, no system has been identified that can adequately deploy absorbent in the catch tank. This option will require the design, fabrication, testing, and operation of a new system.

2) A powder/granule dispersion system must be designed and installed in each riser - A good dispersion of the solidifier material within the waste matrix is essential for some products to ensure no areas of free liquid remain. If the dispersion system utilizes compressed air to disperse the selected polymer into the catch tank dome space, it must be demonstrated that this does not present an increased radiological contamination hazard.
3) The accessible risers for UX302A are located to one side of the existing transfer pump and therefore the dispersion system would have to be designed to go around the pump or the pump would have to be removed.
4) If dispersion is unsuccessful and all liquid is not solidified, pumping may no longer be a viable option. If dispersion is unsuccessful, the pump in the central pump pit may have to be removed to provide access to the center of the tank.
5) Cost – Equipment would have to be designed, tested and installed to facilitate dispersion of the absorbent material. This option may also require a mock-up to demonstrate effectiveness prior to use in the field.
6) The selected absorbent must be evaluated for compatibility with the existing tank waste. This could require additional laboratory testing.
7) The addition of absorbents might complicate the final clean-out and closure of the tank.
8) A new waiver request and safety analysis would be required from ORP due to the significant change in scope of this option compared to the previously presented pumping options.
9) New permits from Washington Department of Health and WDOE may also be required.

Radiological hazards associated with this approach:

1) Assuming the work will consist of adding and not retrieving the absorbent, there will be minimal worker exposure with this option.
2) The spread of radiological contamination may result when removing/installing equipment in tank risers (i.e., absorbent distribution system).
3) If absorbent is dispersed by pneumatic means, the catch tank's interior could become pressurized if the HEPA filter plugs. A sudden release of pressure through a ruptured HEPA filter could expose workers to radiological contamination.

Table 4-7. Cost Estimate to Add Absorbent Material to 241-UX-302A
Note: Cost Estimates are from 241-ER-311 Options Report (RPP-RPT-29484)

Equipment Cost	
- Absorbent material (1,200 lbs)	$6,500
- Absorbent distribution system	$3,000
- Equipment development and testing	$30,000
- Camera System	$30,000
Labor Cost	
- Field labor cost total	$112,500 to $144,000
Disposal Cost	
- 6'x3'x3' mixed waste container	$15,600
- 8'x4'x4' low level waste container	$7,300
Total Cost	**$204,900 to $236,400**

Table 4-8. Labor Estimate to Add Absorbent Material to 241-UX-302A
Note: Labor Estimates are from 241-ER-311 Options Report (RPP-RPT-29484)

Activity Description	Shift Total	Description
Equipment set-up at 241-UX-302A	5½ to 7	Remove ENRAF™, install camera in one riser and Absorbent Distribution System (ADS) in other riser, stage ADS support equipment and connect equipment. ADS must be deployed in both risers.
Add absorbent to West riser	1	Evaluation of application via video inspection is necessary to ensure absorbent is being dispersed adequately.
Add absorbent to East riser	1	Evaluation of application via video inspection is necessary to ensure absorbent is being dispersed adequately.
Dispose of contaminated equipment	4 to 5	This includes absorbent distribution system and camera (if contaminated)
Reinstall ENRAF™	½ to 1	
Install breather filter	½ to 1	
Total Shifts	**12½ to 16**	
Note: Field resource shift estimates include the following resources: five operators, four HPTs, one field work supervisor, one industrial hygiene technician, two fitters, one electrician, one teamster, two mechanical engineers, one radiological control manager, and one facility manager.		

NOTE: The risers in UX302A are located within 5 feet of each other therefore only one riser would be used as a dispersion point.

Figure 4-4. Add Absorbent Material to 241-UX-302A (Pump Distribution Method)
Note: This figure is a conceptual representation and does not depict the actual 241-UX-302A catch tank configuration

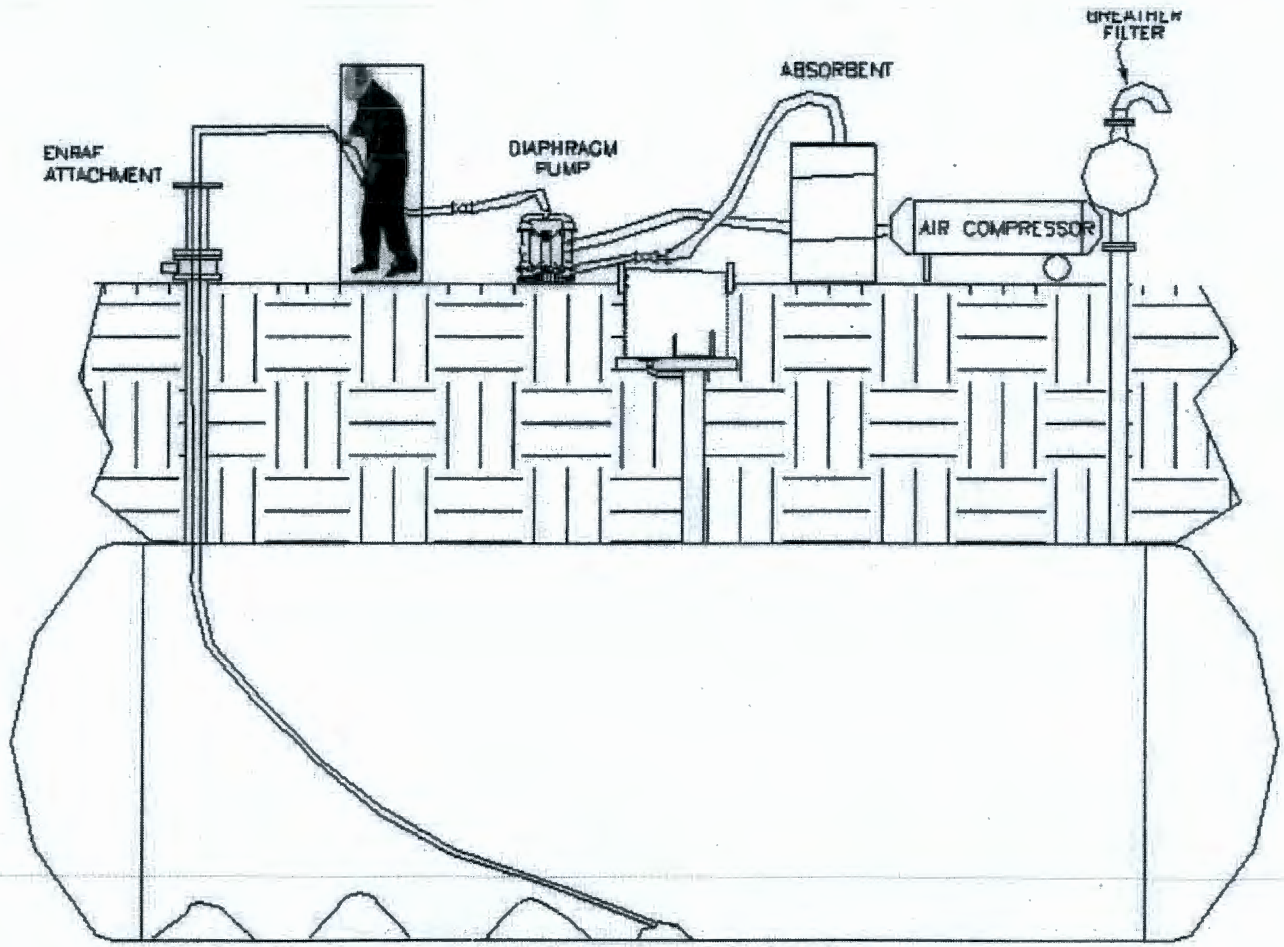
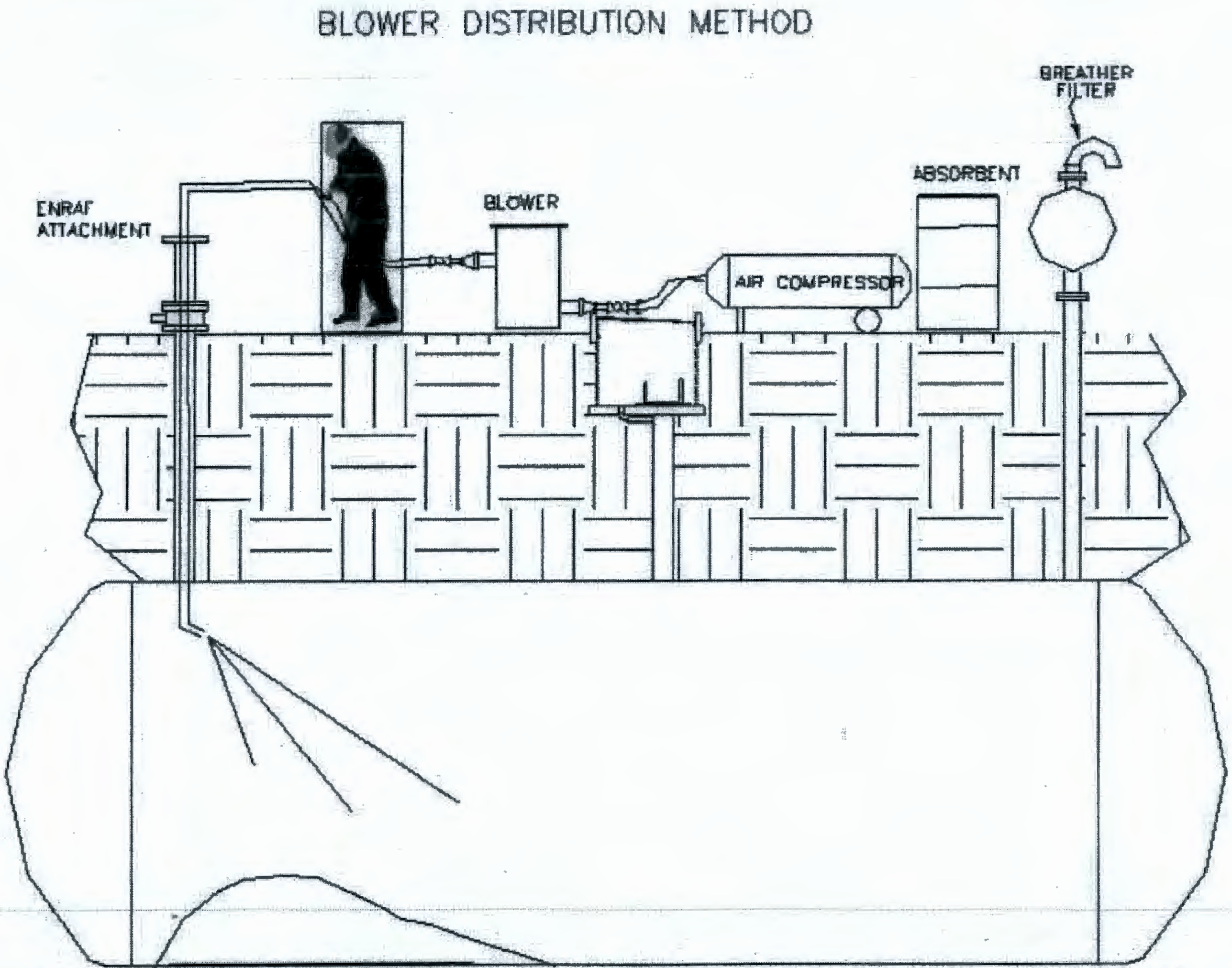


Figure 4-5. Add Absorbent Material to 241-UX-302A (Blower Distribution Method)



Note: This figure is a conceptual representation and does not depict the actual 241-UX-302A catch tank configuration

5.0 CONCLUSION

The environmental risks and hazards that would result if the remaining free liquid in catch tank 241-UX-302A were to leak to the environment have been determined to be minimal. Sampling data obtained in 2002 indicates that the liquid in catch tank 241-UX-302A contains mostly water with minimal radiological and toxicological constituents. The majority of the radiological hazards are associated with the solids, which are anticipated to remain in the subject catch tank.

The recommended option from this evaluation is to remove the remaining pumpable liquid from the tank and to continue to perform monitoring and surveillance on the catch tank contents. After pumping, minimal free liquid with very low concentrations of radiological or toxicological constituents will remain in catch tank 241-UX-302A and the environmental impact of a future leak of the remaining liquid is low. Provisions are already in place to minimize future intrusion into this catch tank, and liquid level monitoring will detect if any additional intrusion and accumulation should occur. This option has advantages in that it minimizes the available liquid that could possibly leak and cause further migration of contaminants into the soil.

An option to only apply continued monitoring and surveillance, while cost effective and easily implemented, does not offer the ability to minimize the available liquid that could possibly leak and cause further migration of contaminants into the soil.

The other options presented in this evaluation were not selected due to limited effectiveness, uncertainties, or potential adverse impacts for the final clean-out and closure of the tank.

6.0 REFERENCES

RPP-RPT-29484, Rev. 0, 2006, *Options for Responding to the Assumed Leak from Catch Tank 241-ER-311*, May 2006, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-29711, Rev. 0, 2006, *Tank 241-UX-302A Leak Assessment Report*, May 2006, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-6829, Appendix C, 2001, *Engineering Report on Double-Shell Tank System Miscellaneous Tanks*, CH2M HILL Hanford Group, Inc., Richland, Washington.

FH-0203447, 2002, *Tank 241-UX-302A FY2002 Grab Samples Analytical Results for the Final Report*, Fluor Hanford, Richland, Washington.

OSD-T-151-00031, 2006, *Operating Specifications for Tank Farm Leak Detection and Single Shell Tank Intrusion Detection*, CH2M HILL Hanford Group, Inc., Richland, Washington.

TFC-ENG-CHEM-D-42, 2005, *Tank Leak Assessment Process*, CH2M HILL Hanford Group, Inc., Richland, Washington.

WAC 173-303, as amended, "Dangerous Waste Regulations," *Washington Administrative Code*.

APPENDIX A

CATCH TANK 241-UX-302A CONFIGURATION AND ABOVE GROUND SITE PICTURES

Figure A-1. Layout of 241-UX-302A (Taken from H-2-71665)

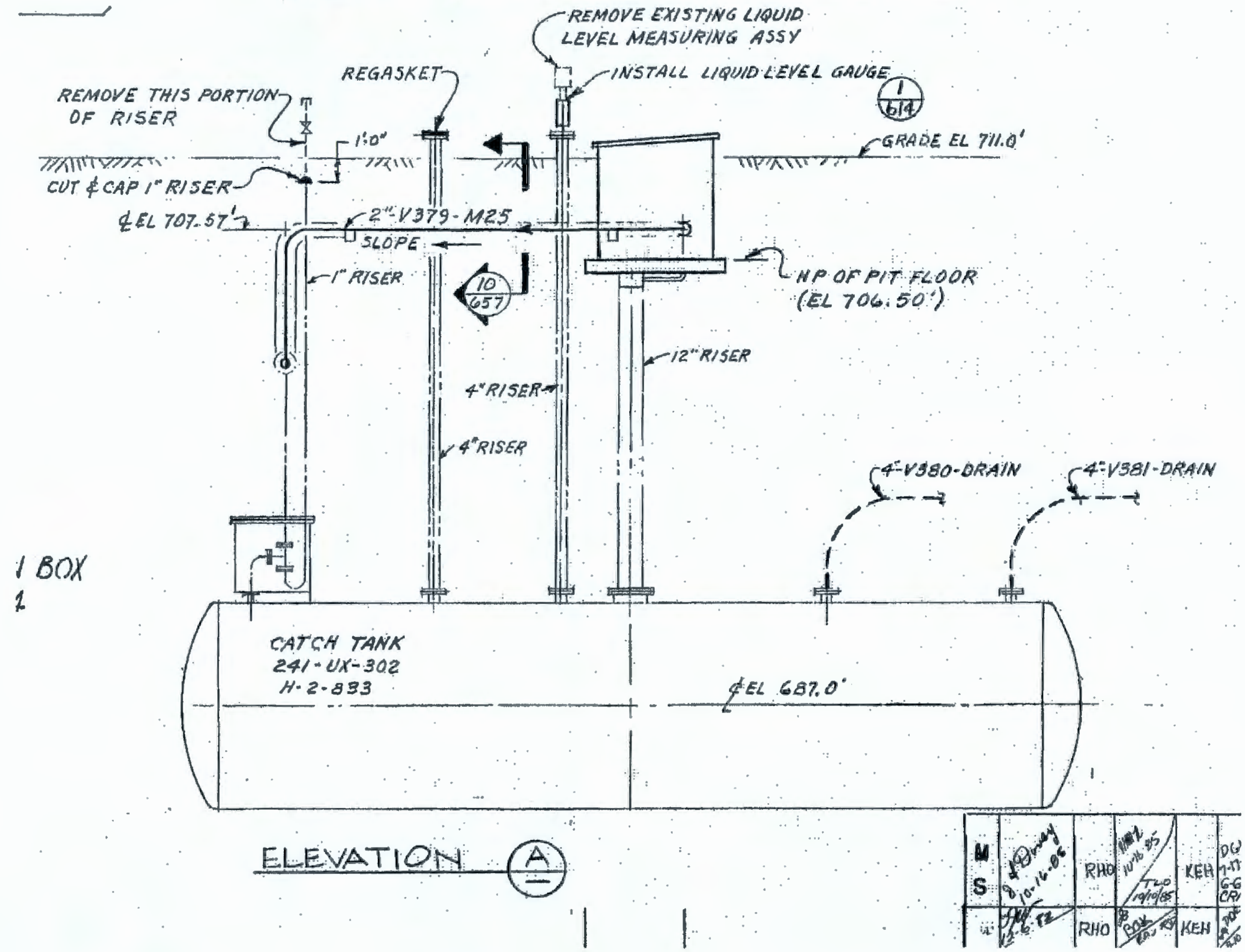


Figure A-2. Above tank view of UX-302A looking toward street

Figure A-3. Above tank view of UX-302A looking toward 221-U building

APPENDIX B

PCSACS ENRAF™ LEVEL READINGS

Figure B-1. PCSACS ENRAF™ (December 1, 2005 to August 10, 2006)

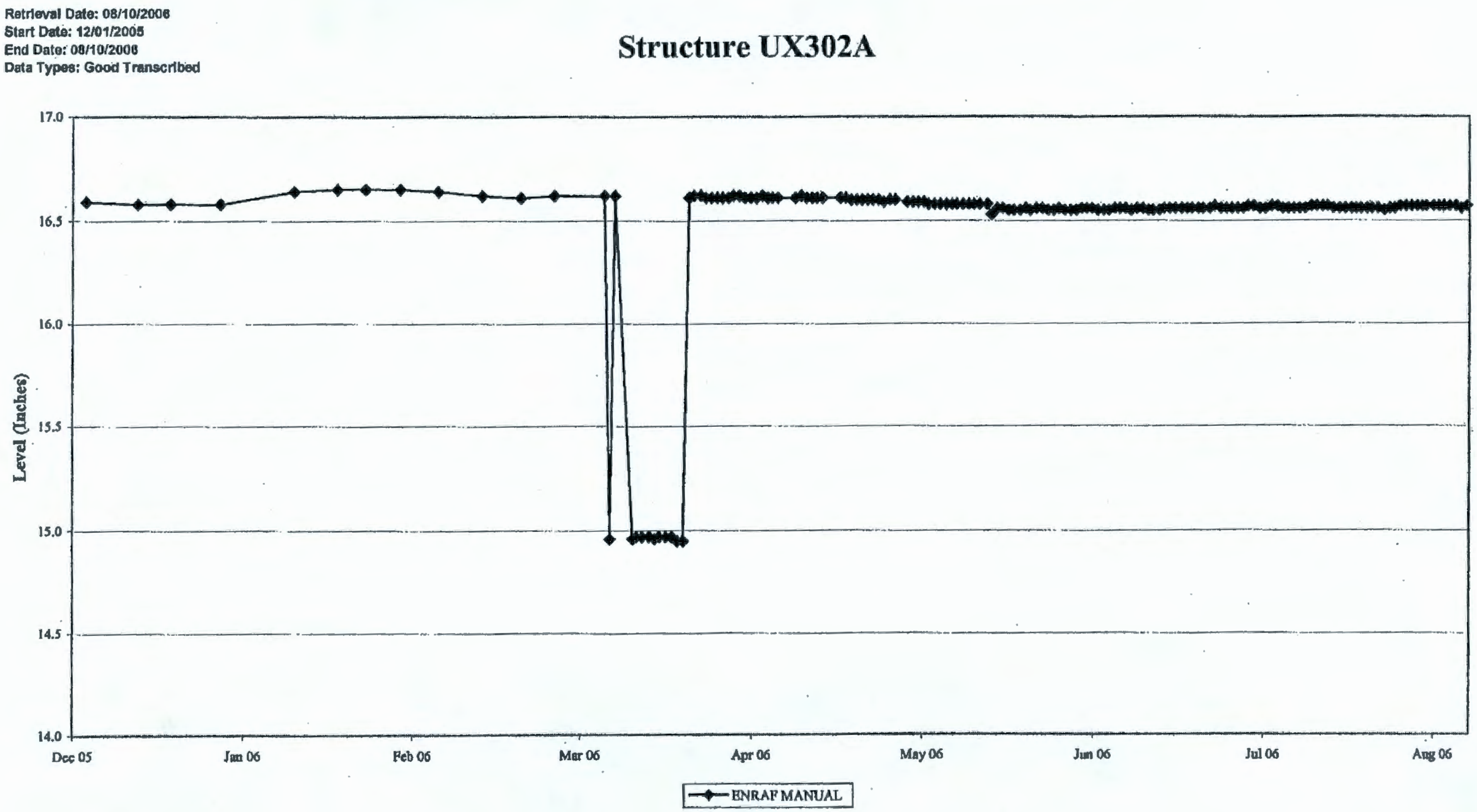
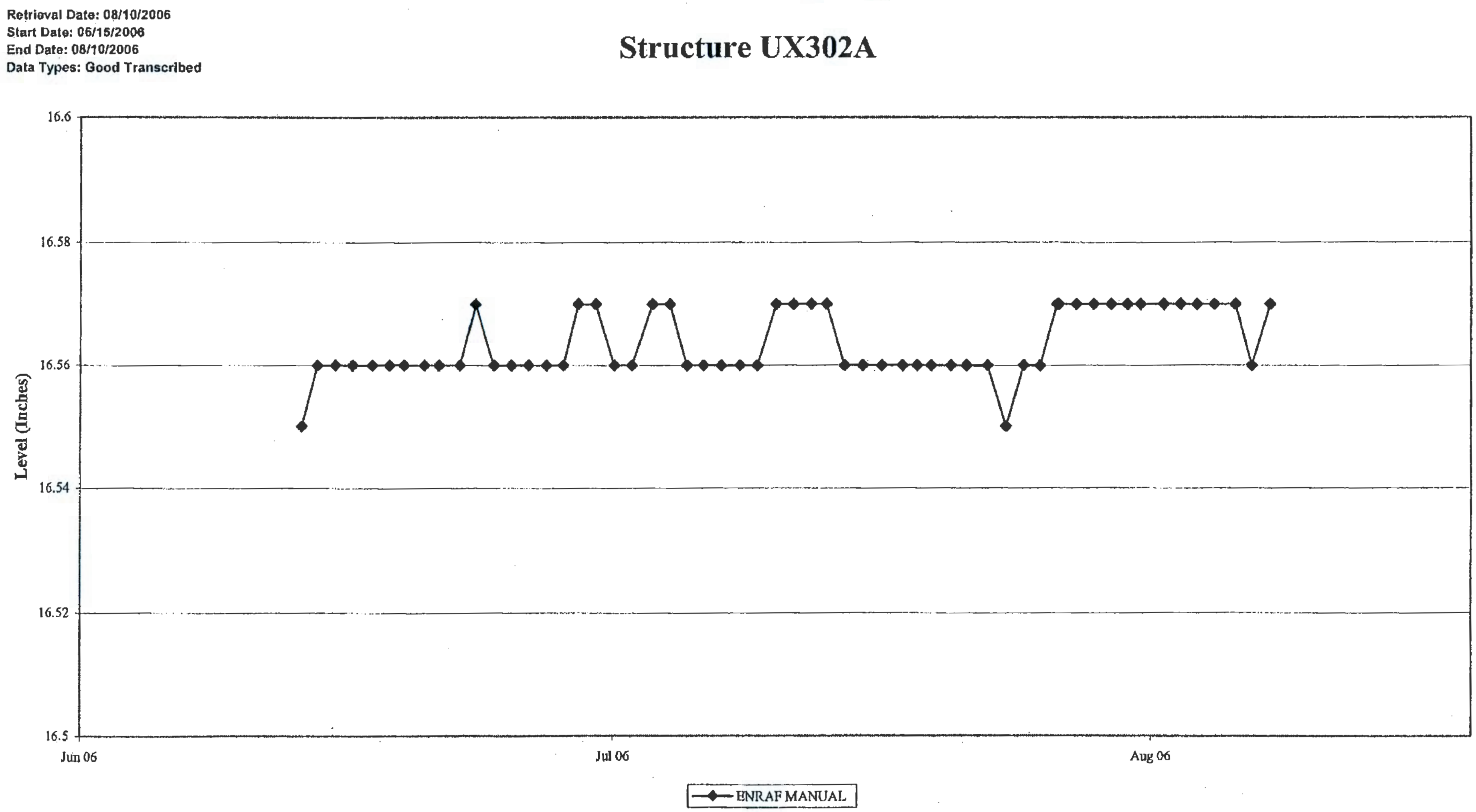


Figure B-2. PCSACS ENRAF™ (June 15, 2006 to August 10, 2006)



APPENDIX C

CATCH TANK 241-UX-302A IN-TANK IMAGES

Figure C-1. In-Tank Photo – East End of Catch Tank 241-UX-302A

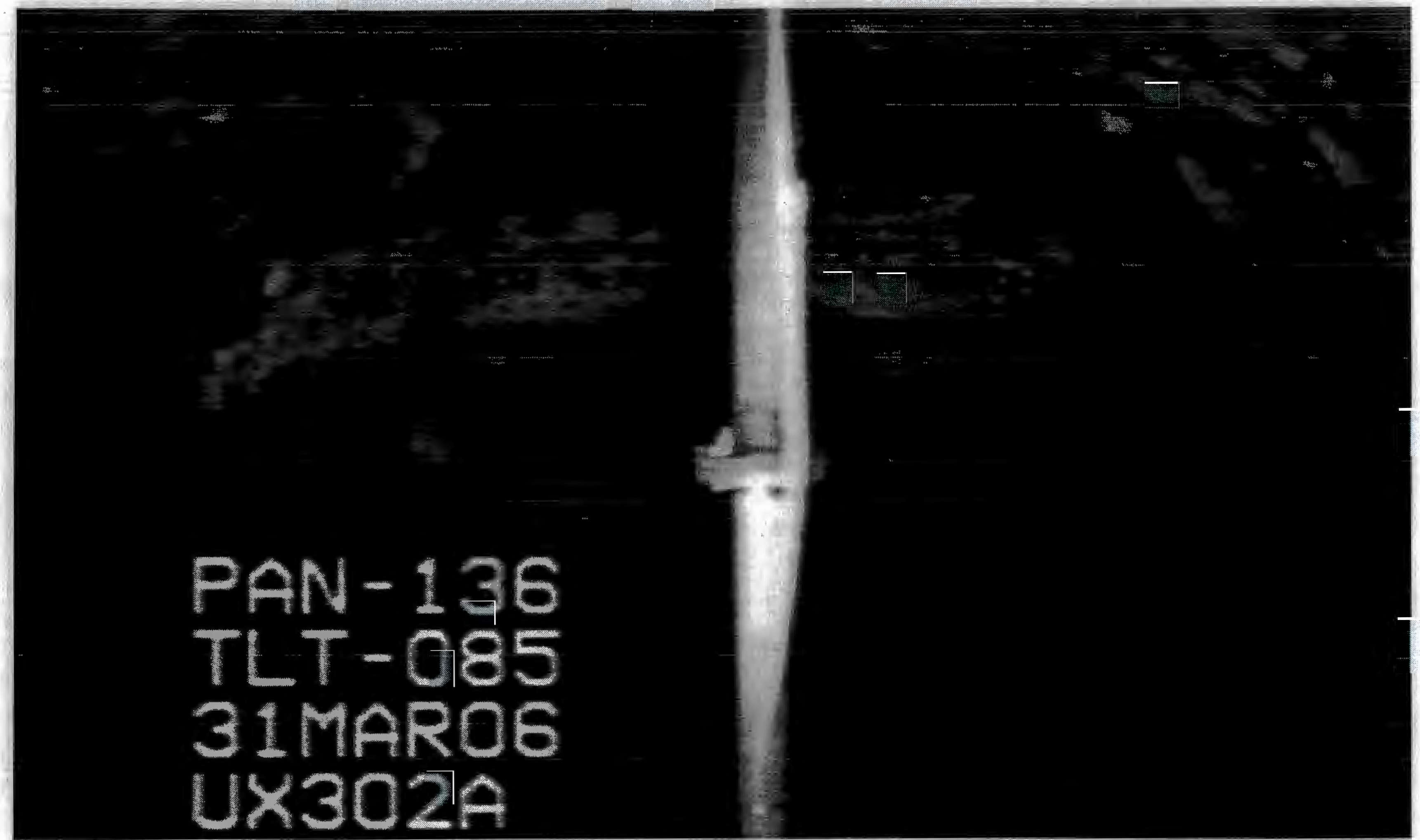


Figure C-2. In-Tank Photo – West End of Catch Tank 241-UX-302A

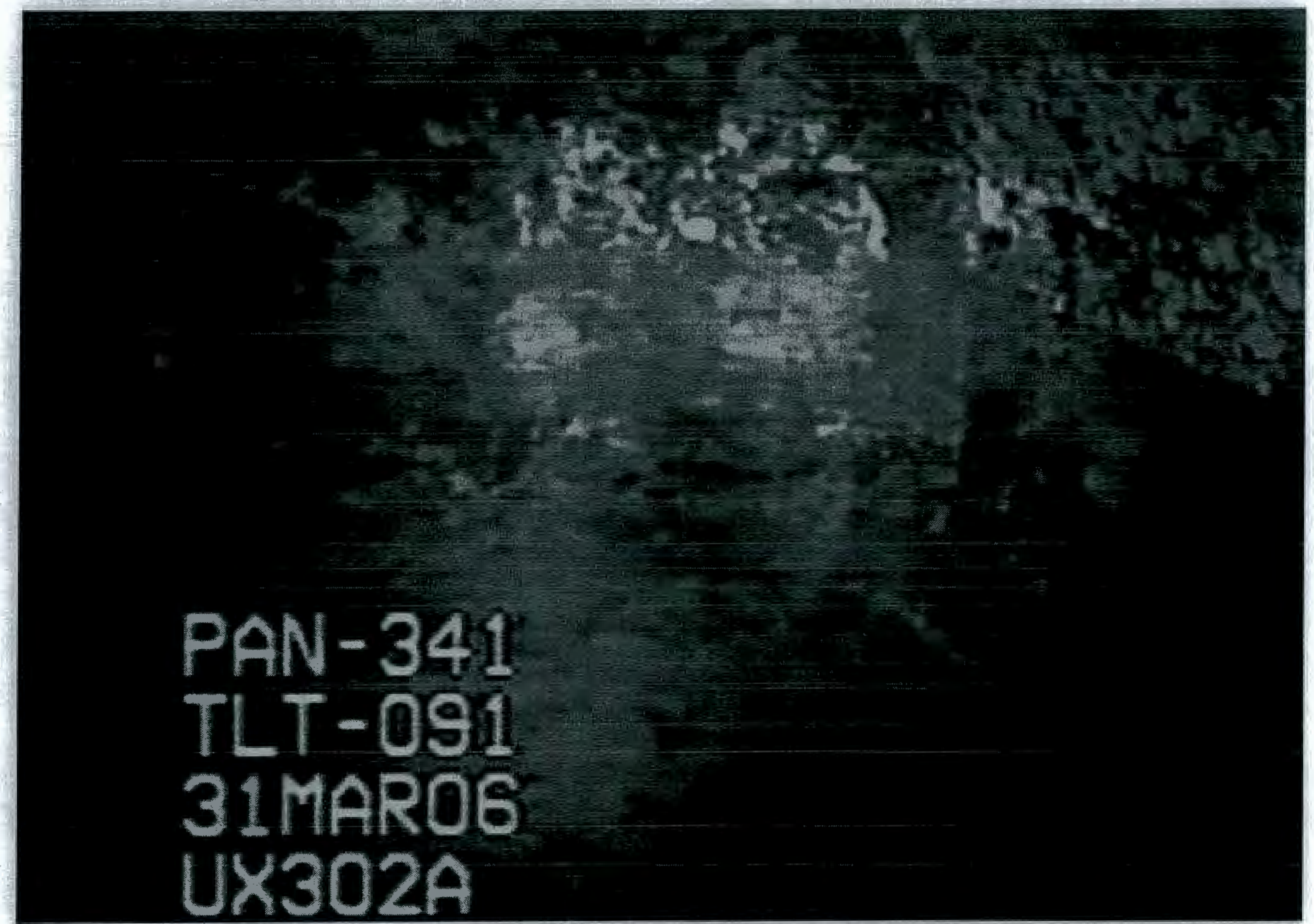


Figure C-3. In-Tank Photo – Installed Pump and ENRAF™ Visible Near Center of Catch Tank 241-UX-302A

Figure C-4. In-Tank Photo – View Showing Liquid and Solids

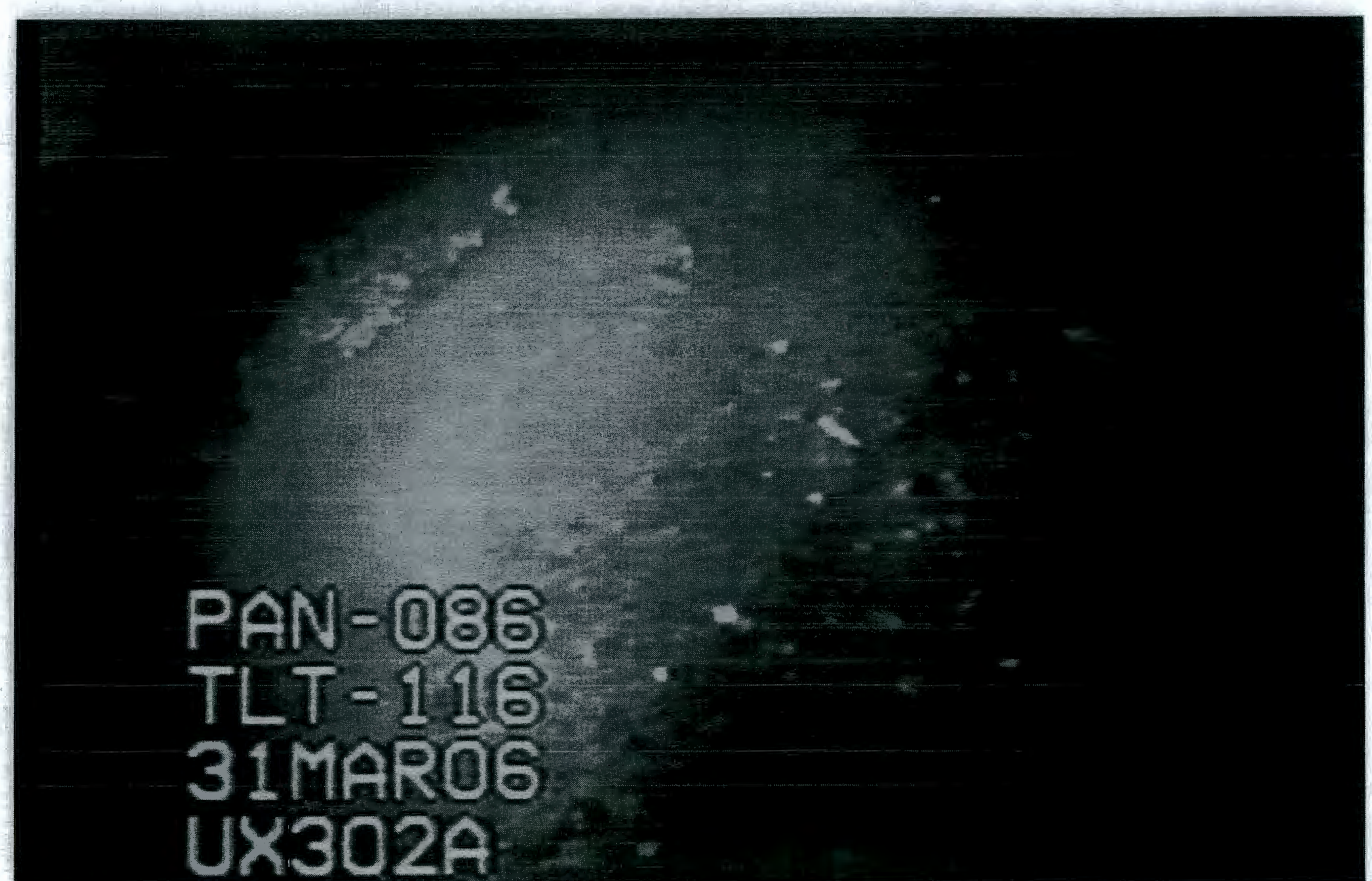


Figure C-5. In-Tank Photo – View Directly Below Riser